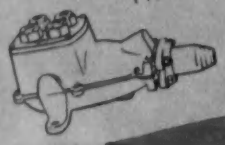
17 MARCH 1955 ONE SHILLING

ELECTRICAL TIMES

This *one* box –

VERTICAL CIRCULAR TYPE



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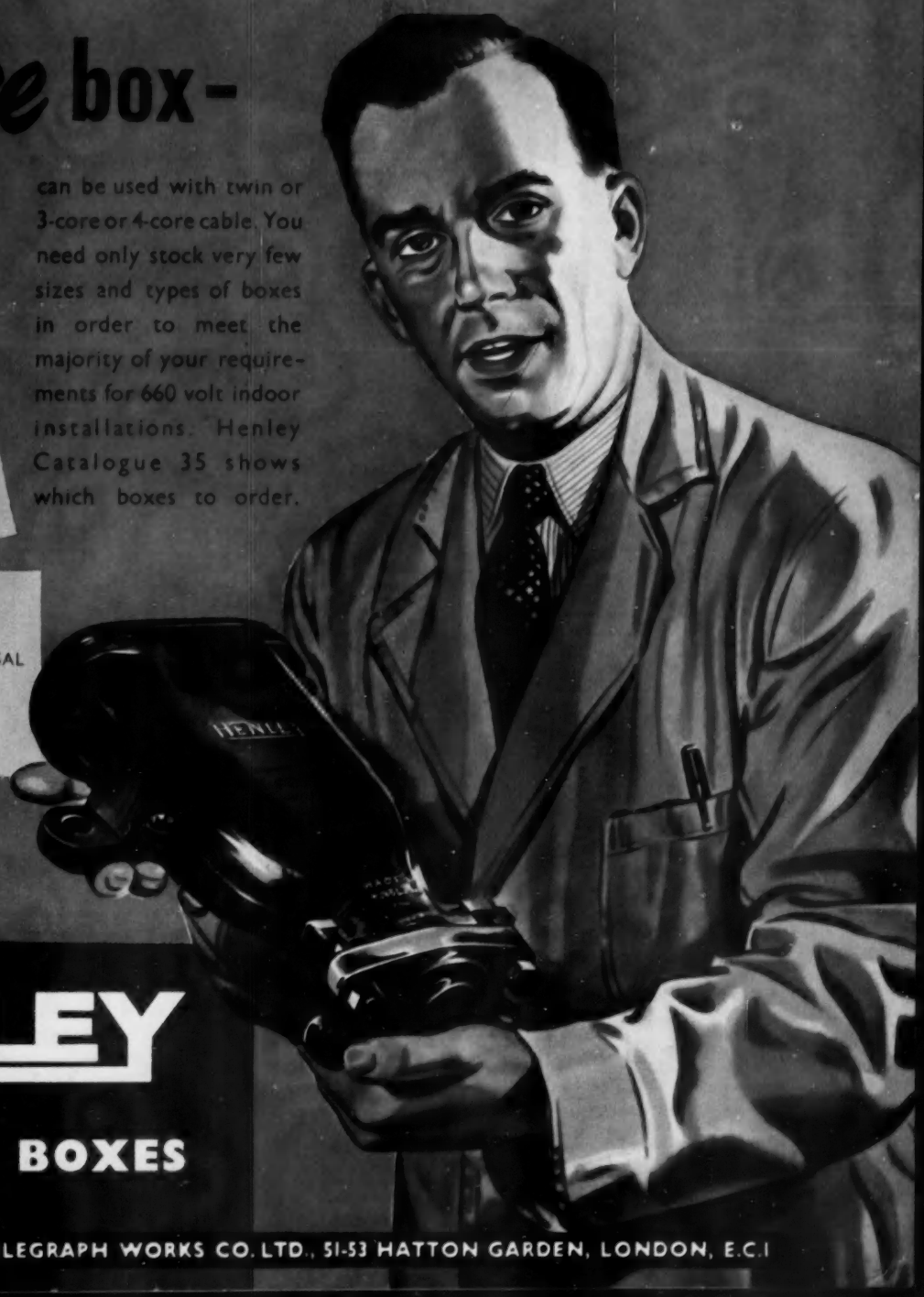
UNIVERSAL FLAT TYPE

FLANGE MOUNTING TYPE for inverted use

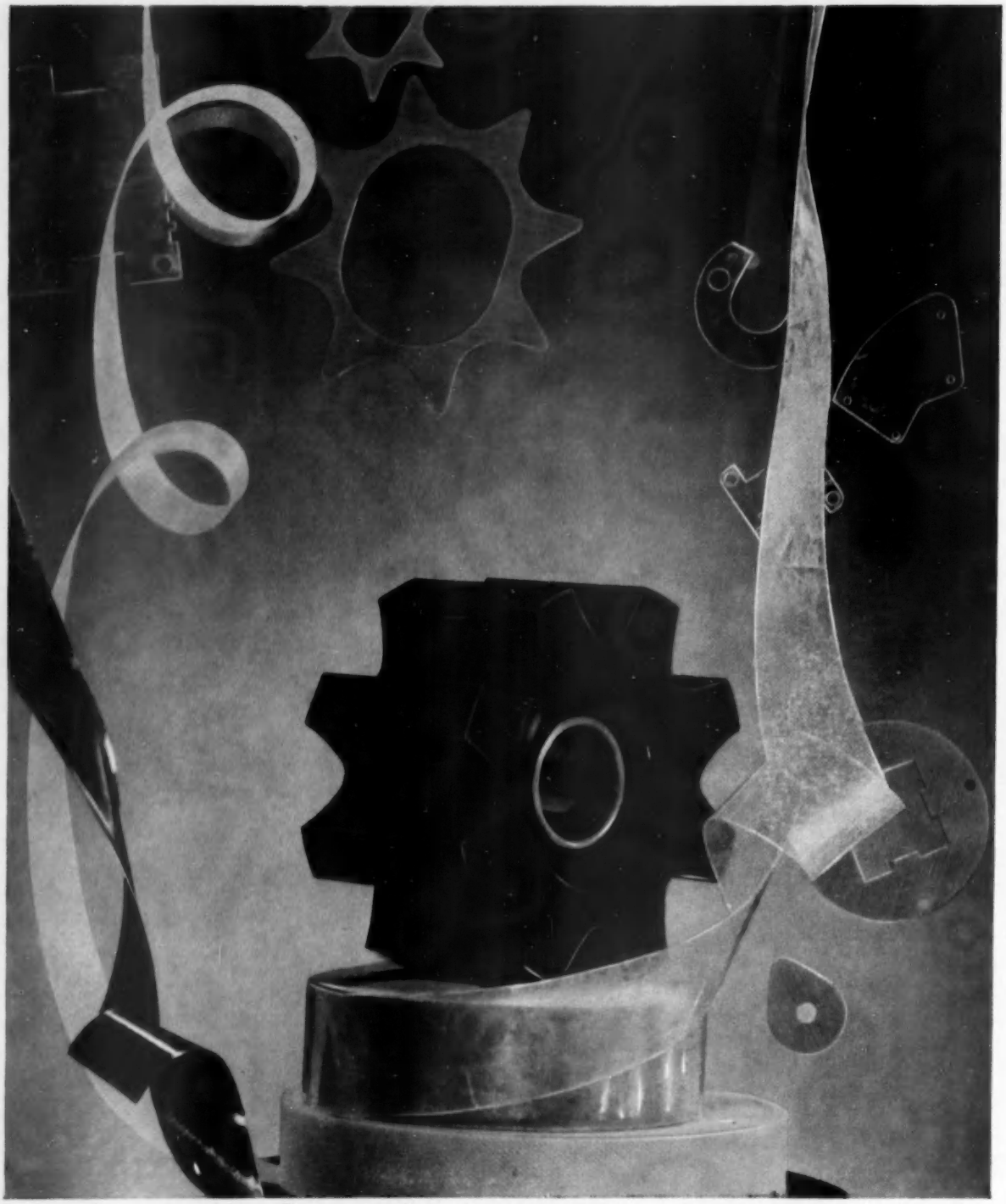
can be used with twin or 3-core or 4-core cable. You need only stock very few sizes and types of boxes in order to meet the majority of your requirements for 660 volt indoor installations. Henley Catalogue 35 shows which boxes to order.



HENLEY

INDOOR
TERMINAL BOXES
660 volts

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1



Examples of our many activities. The pump impeller is a Panilax Resin Moulding and is supported upon rolls of Mica Tape and Empire tape. The punchings include Micanite, Paxolin Laminated and Mica.

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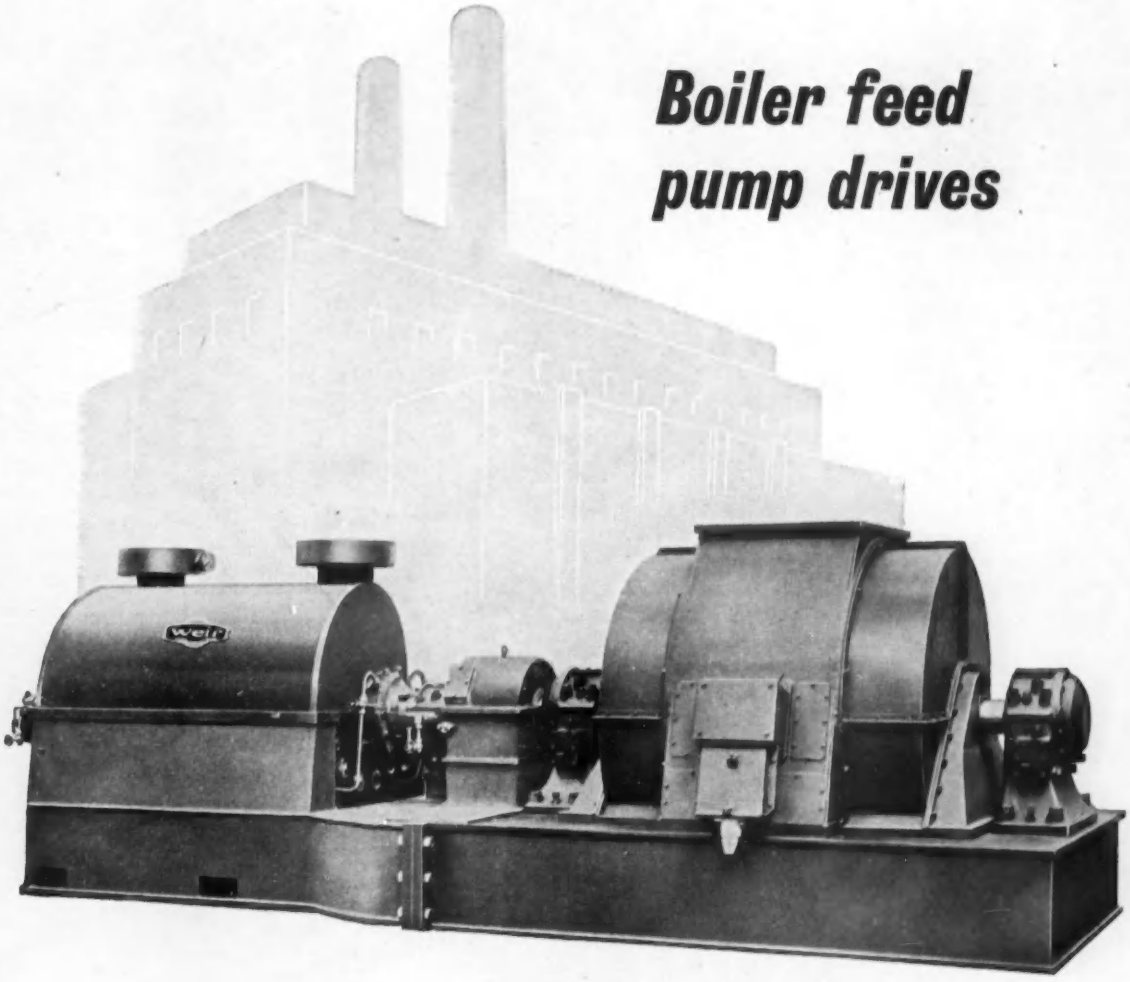

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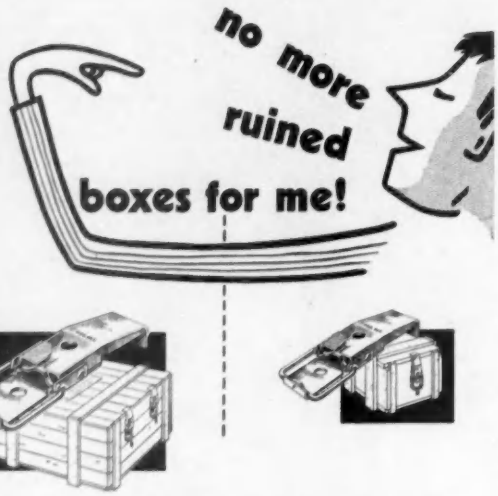

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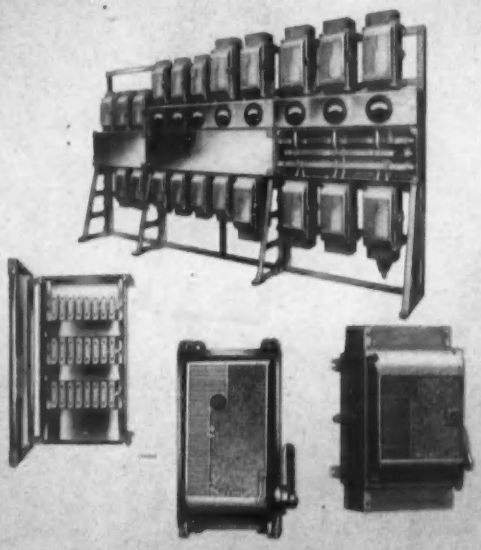

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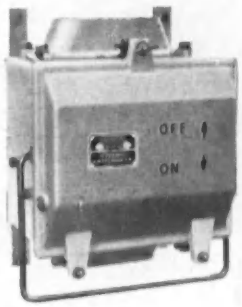

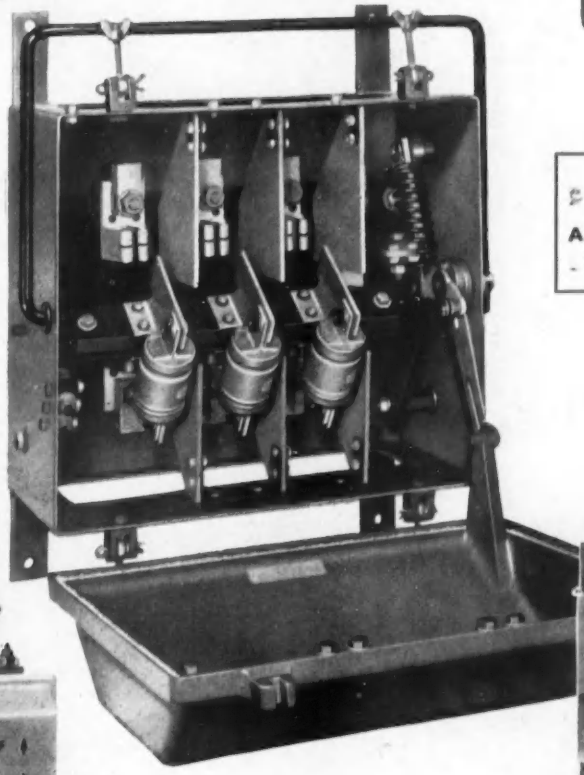

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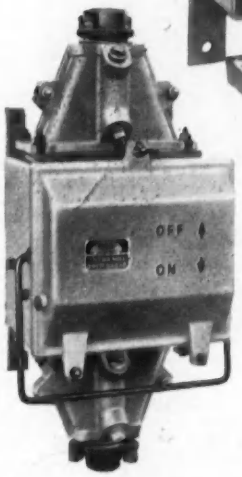

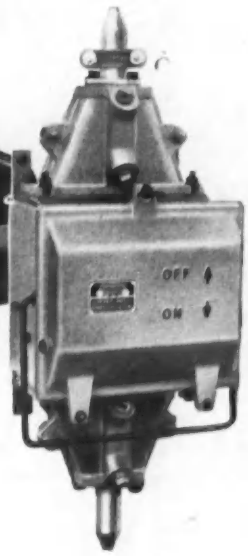

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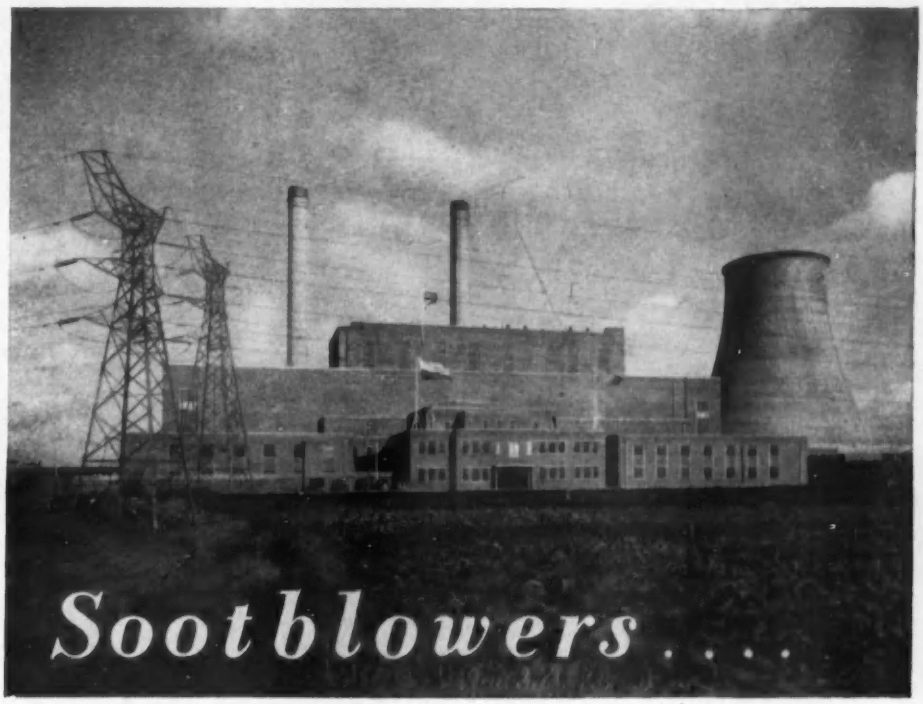

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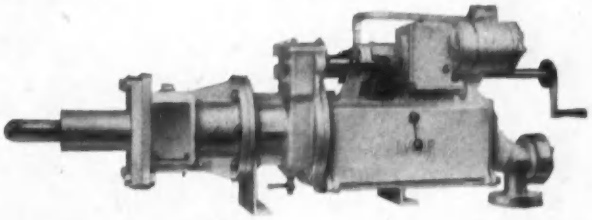

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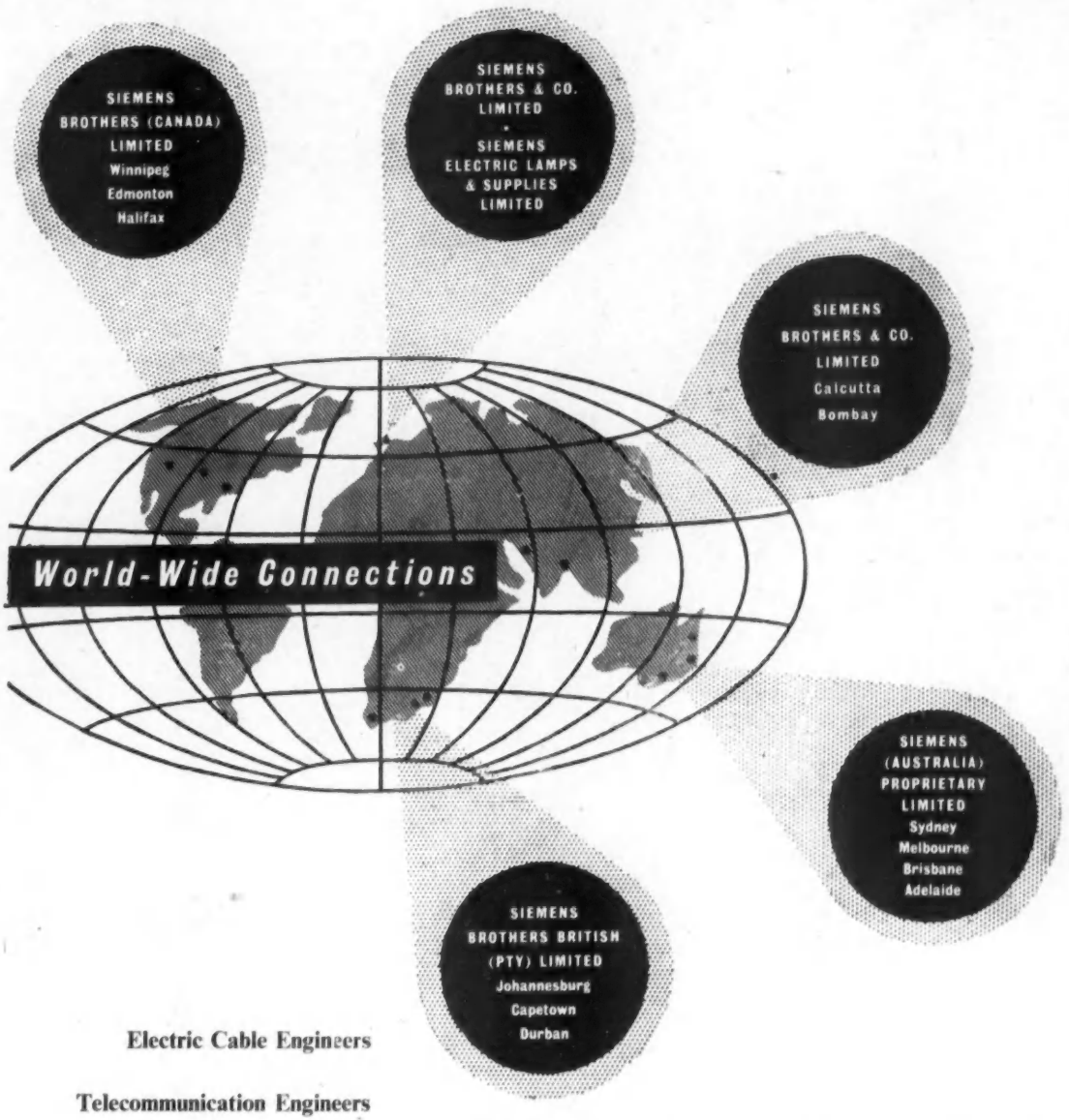

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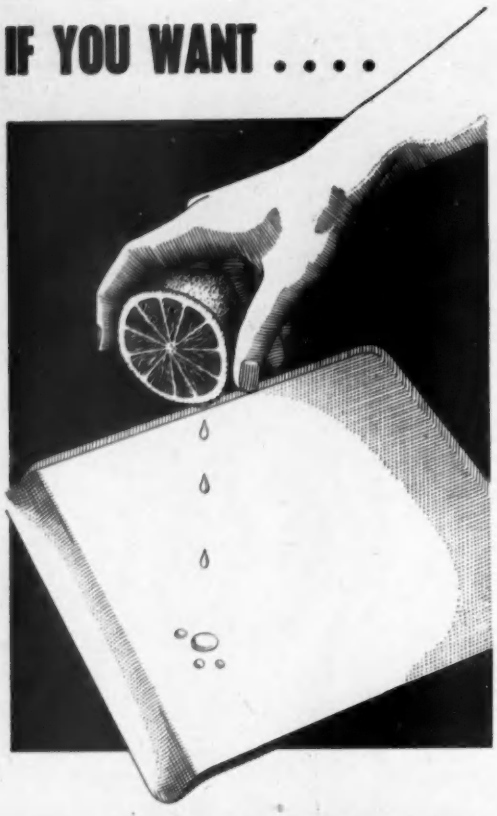

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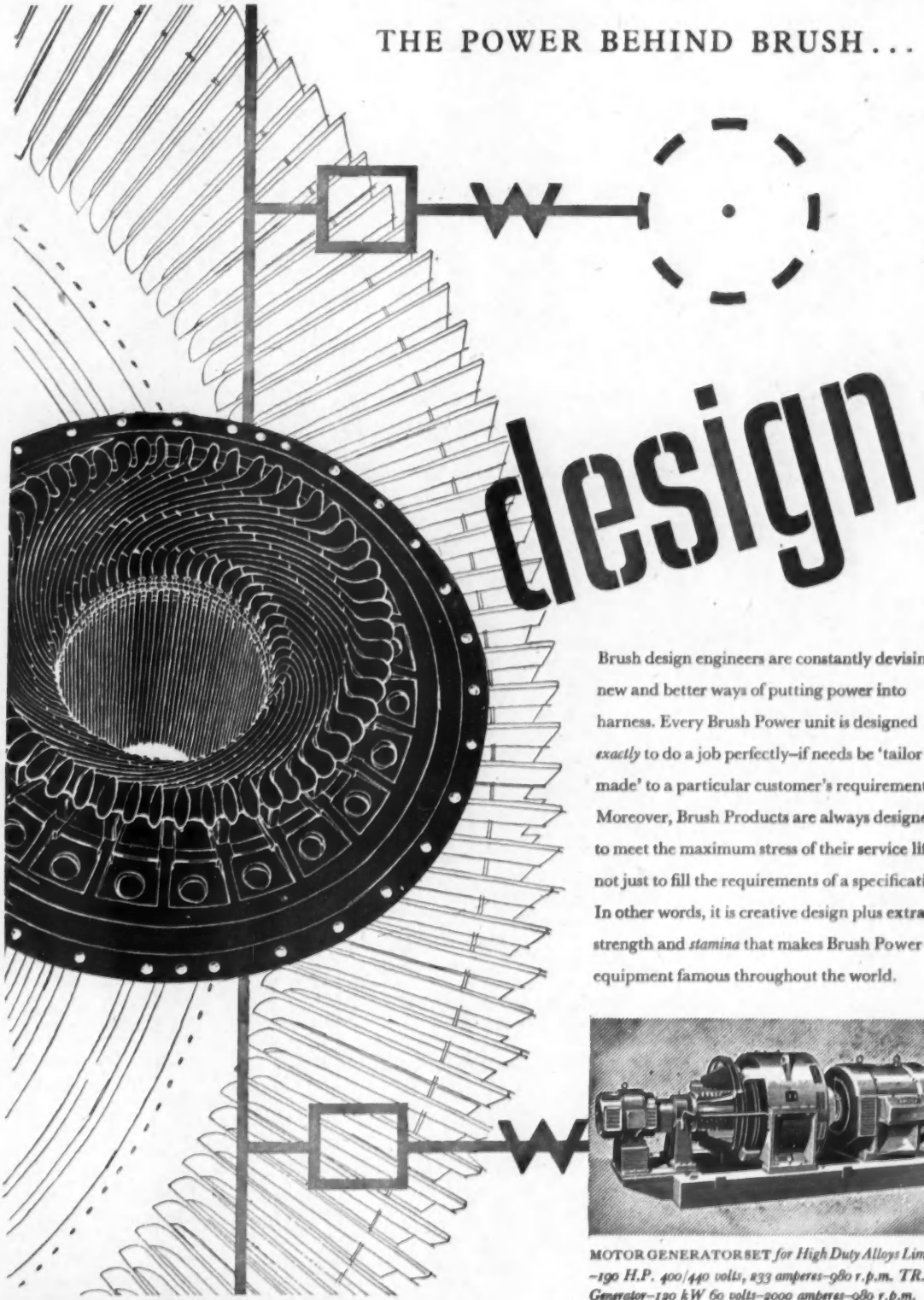

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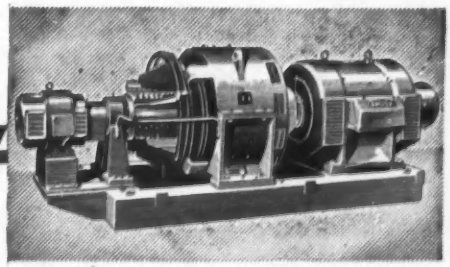

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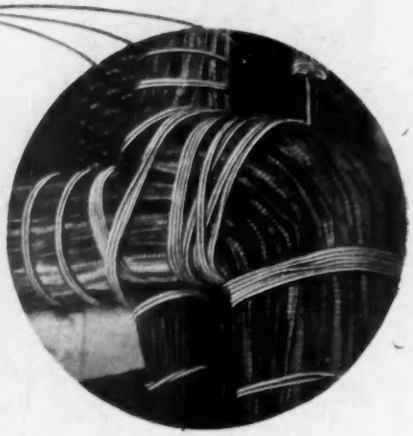

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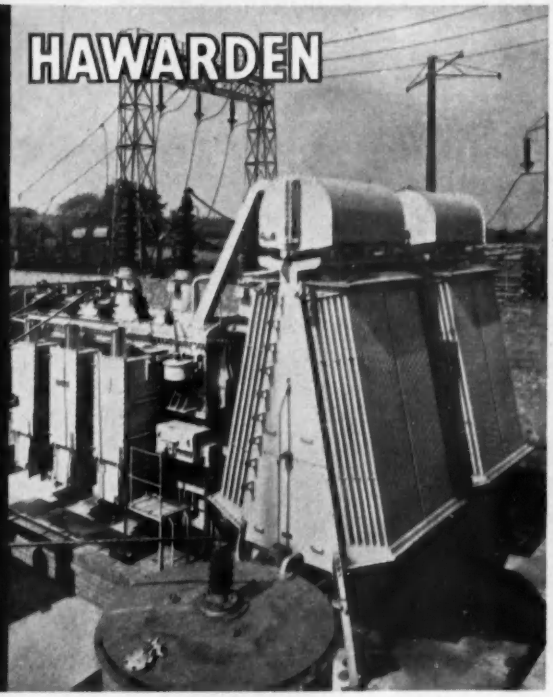

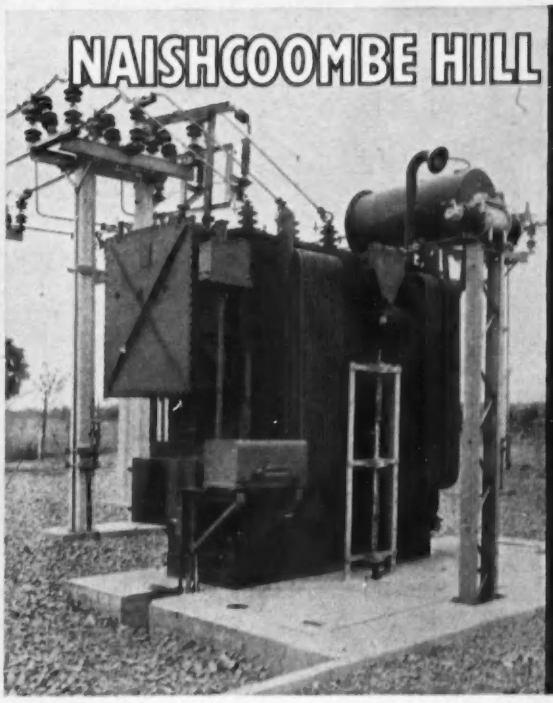

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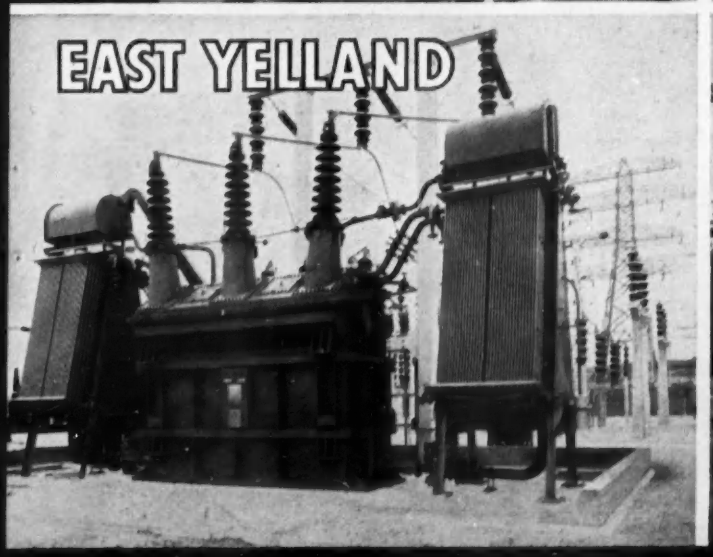

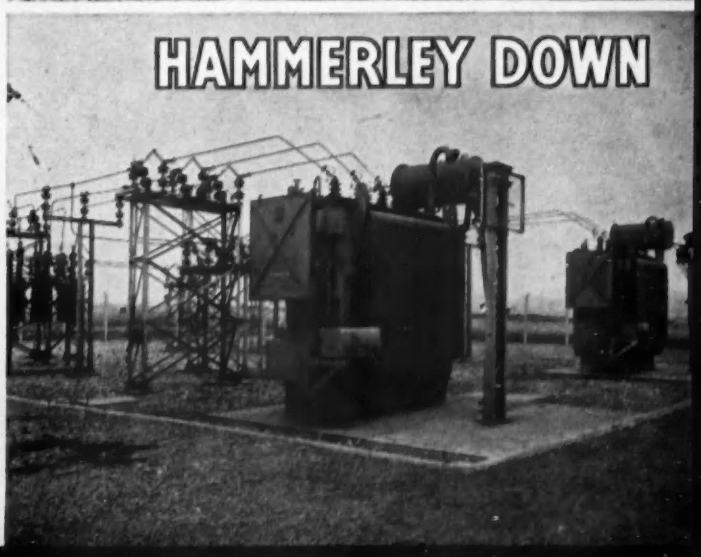

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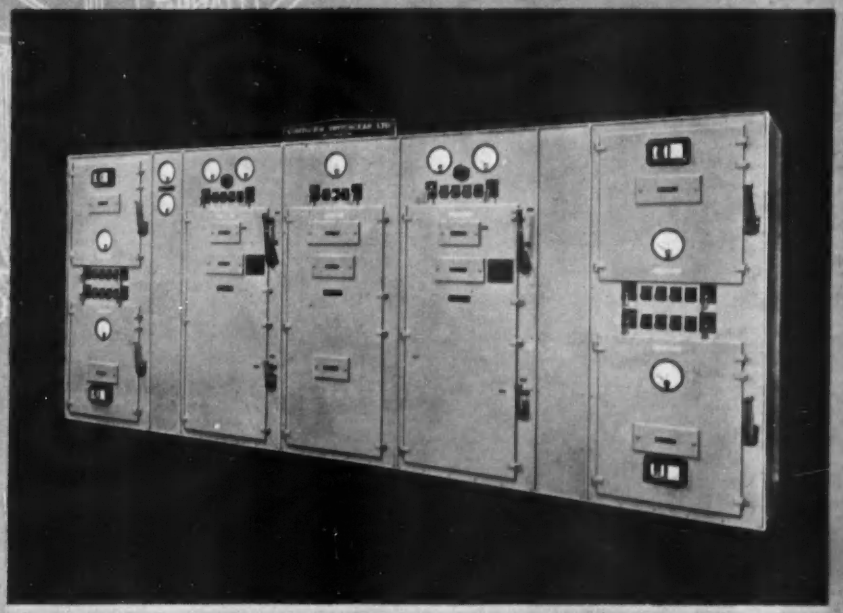

For Power Stations

Contactor type auxiliary switchboards have been supplied by CONTACTOR SWITCHGEAR LTD. to a very considerable number of power stations at home and abroad.

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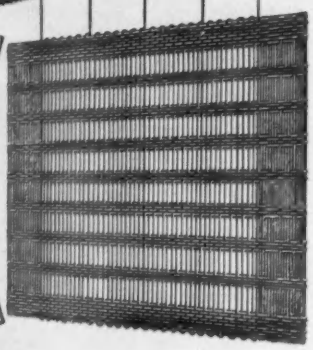

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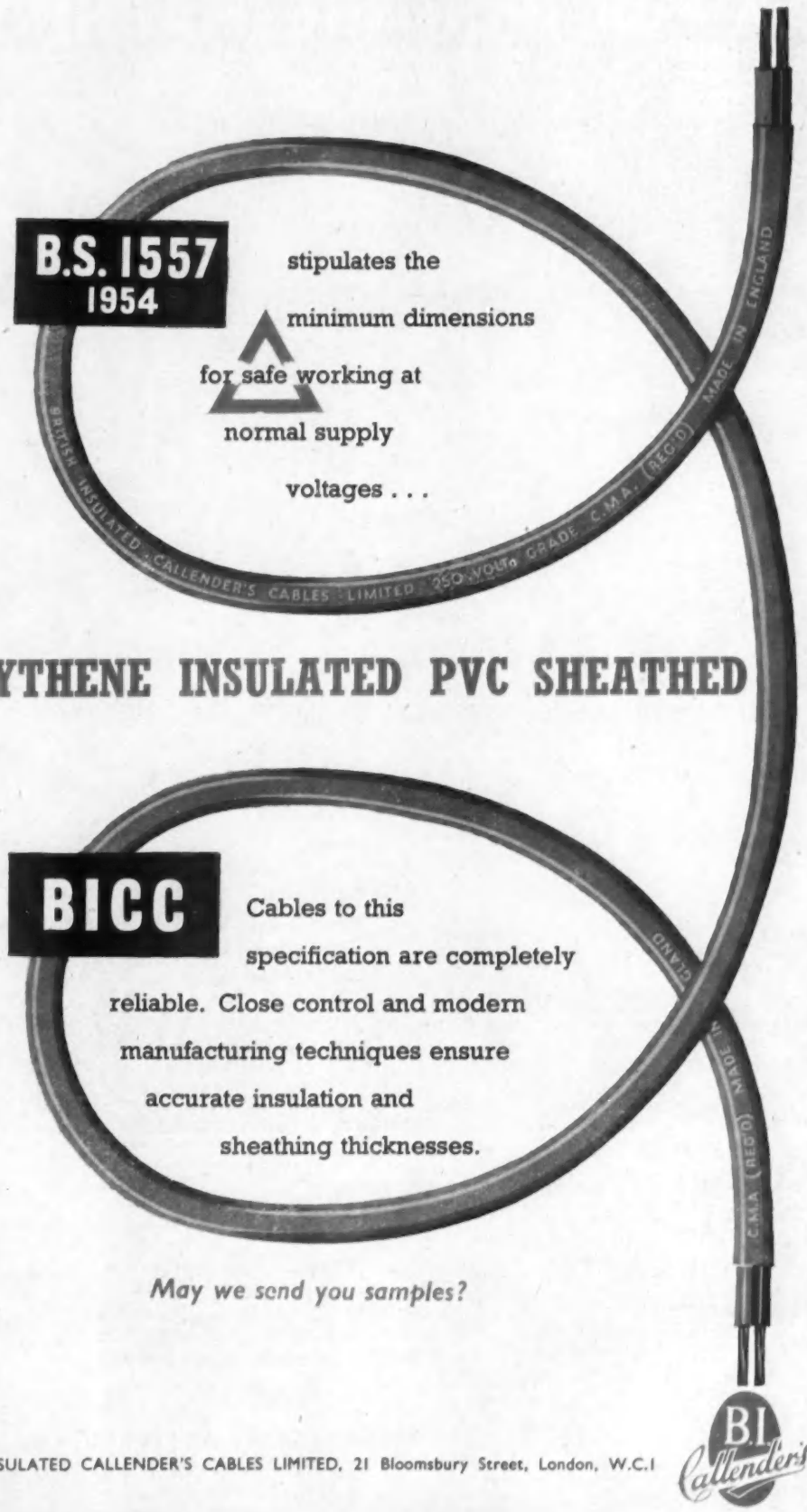

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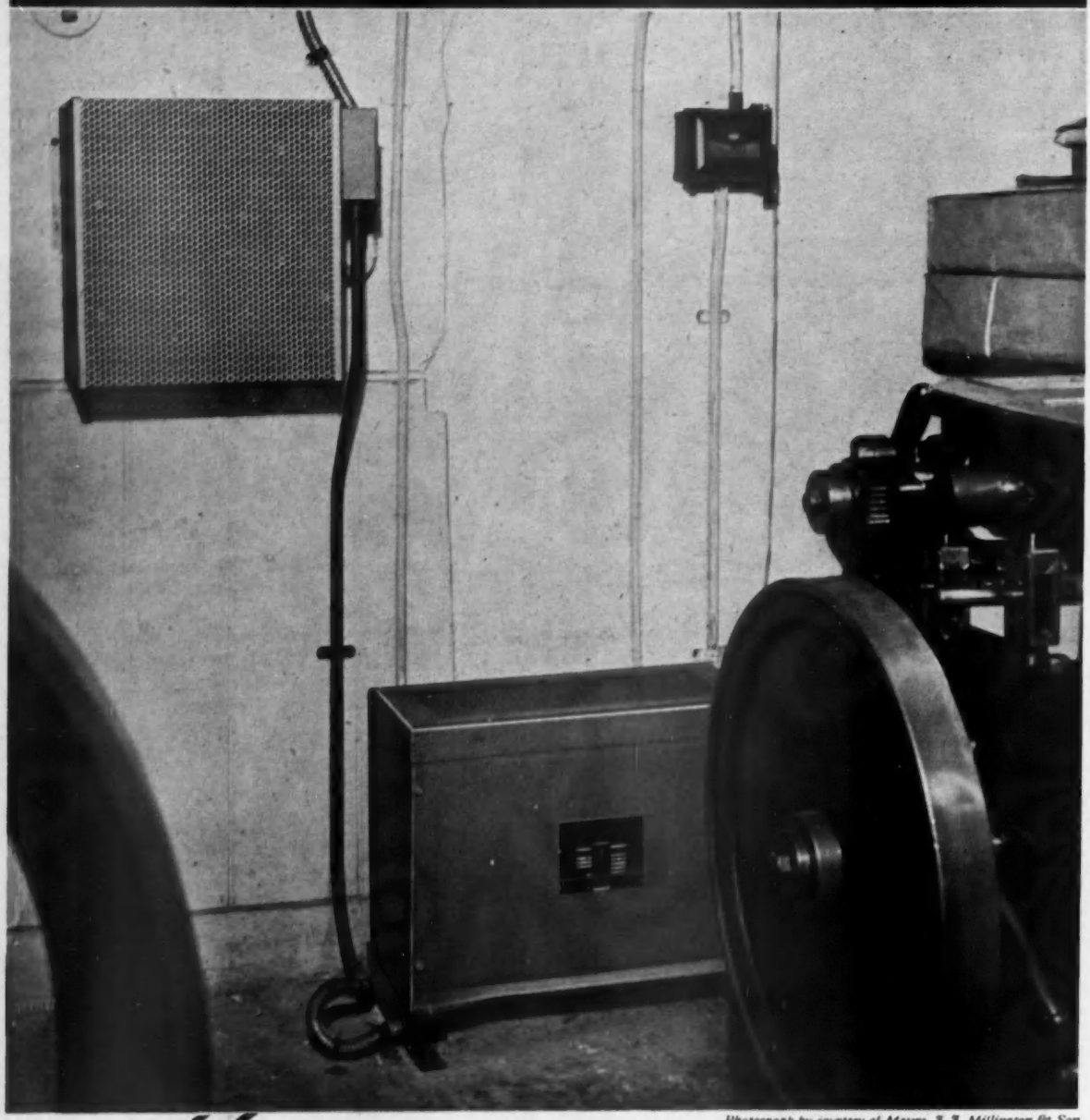

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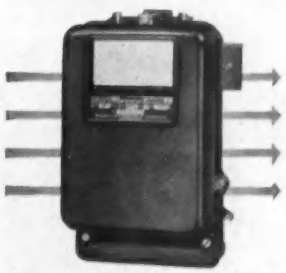

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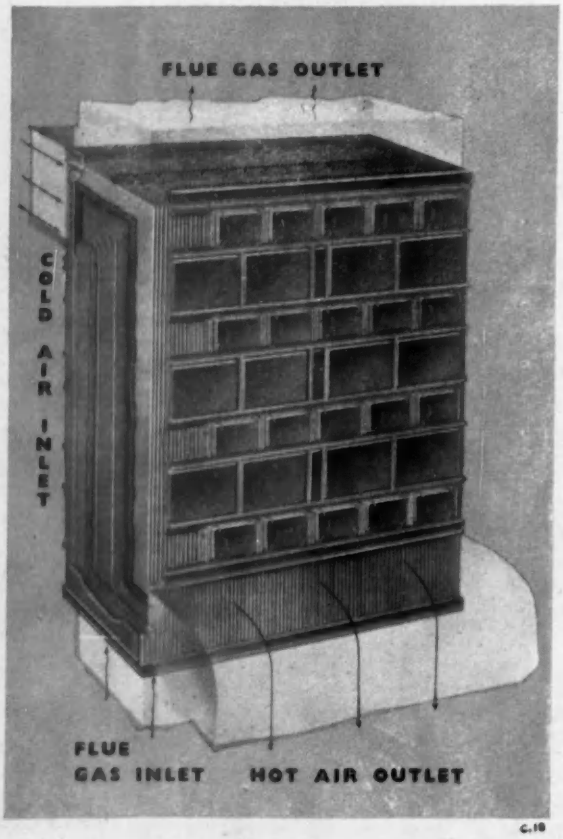
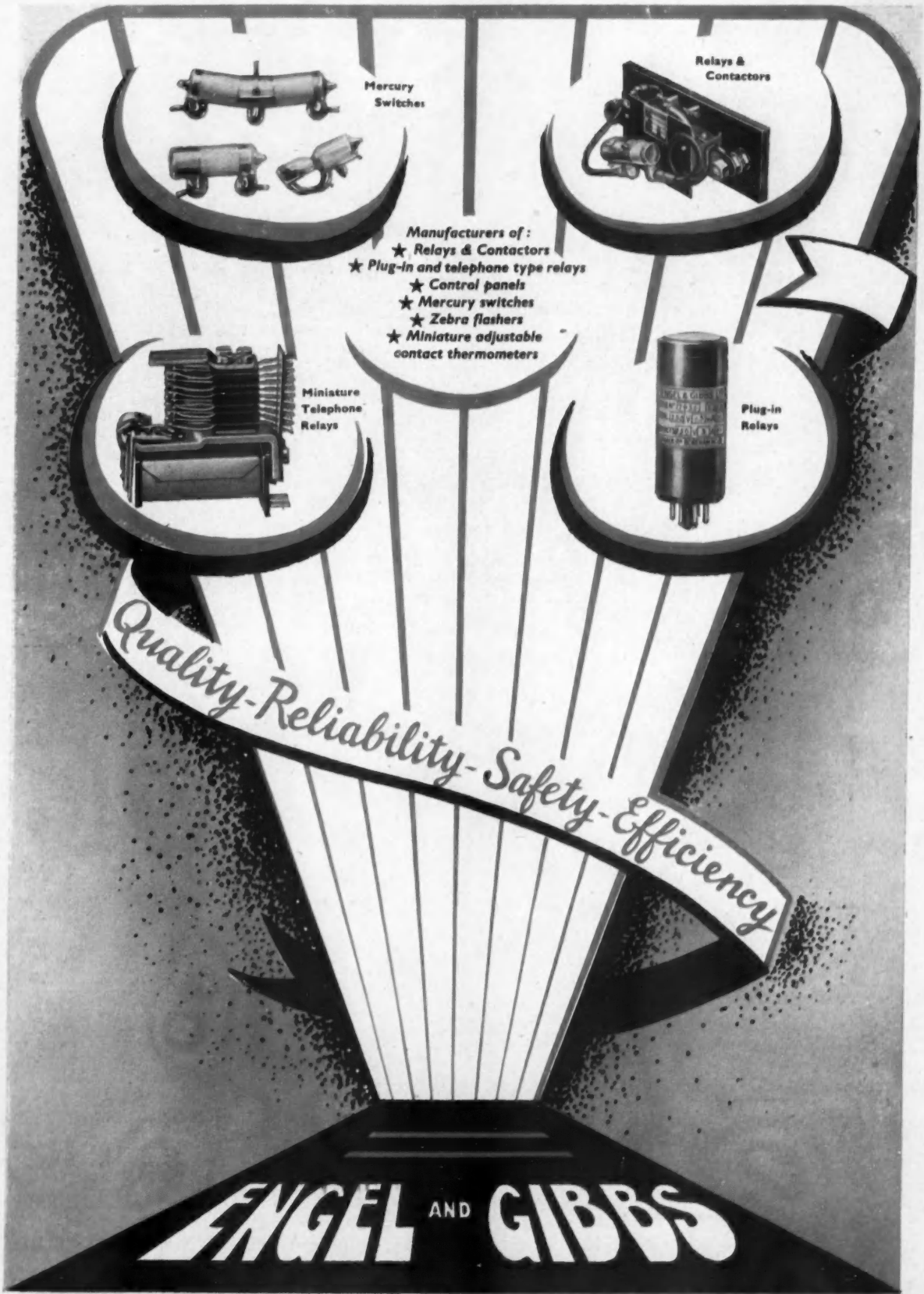


C.10



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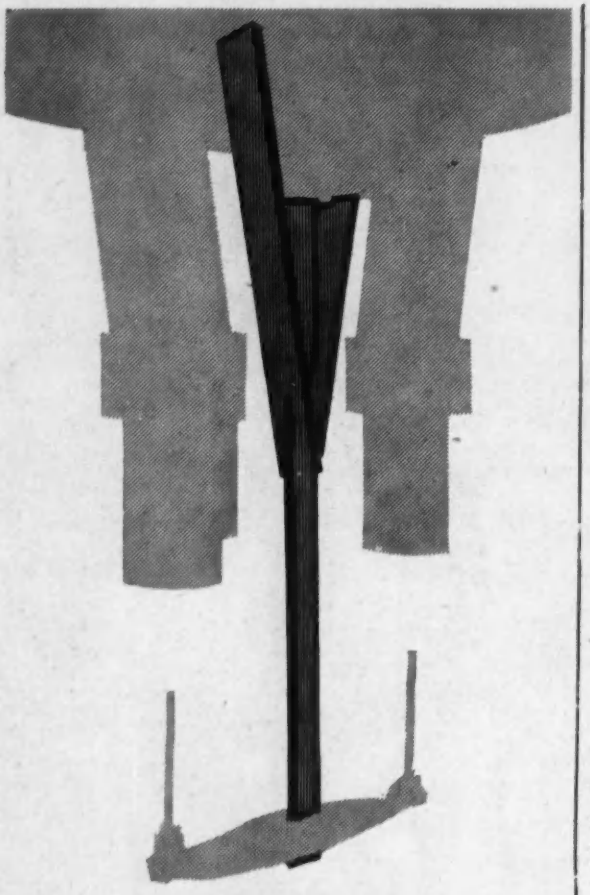

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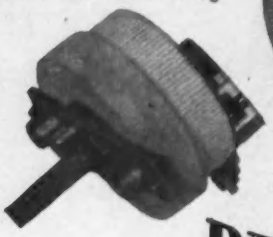

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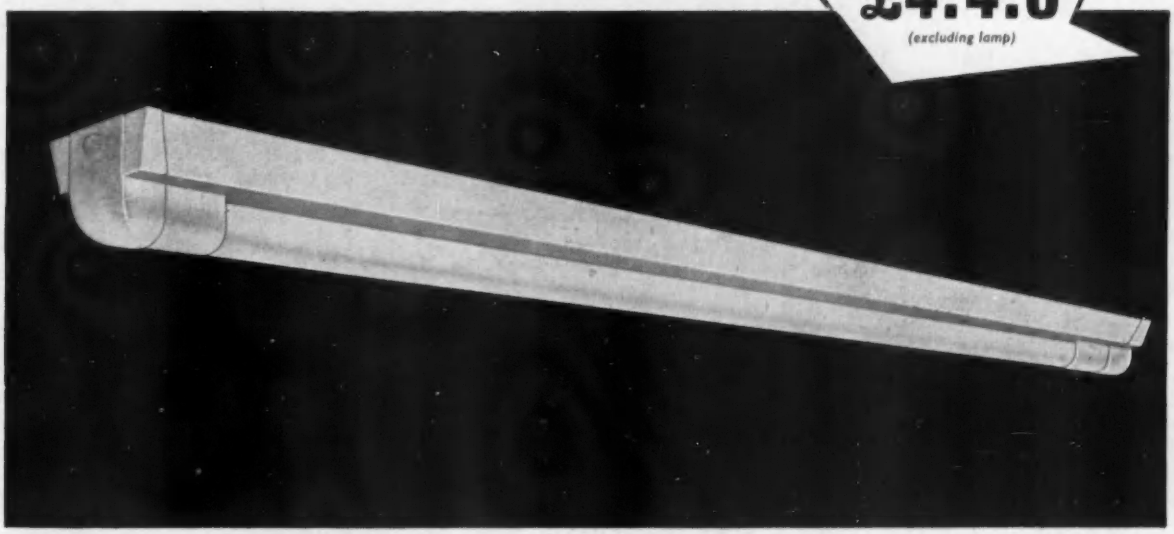

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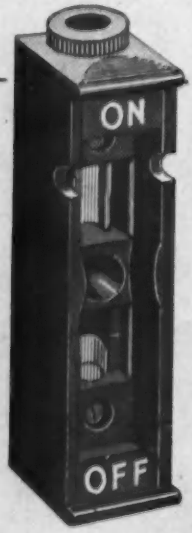

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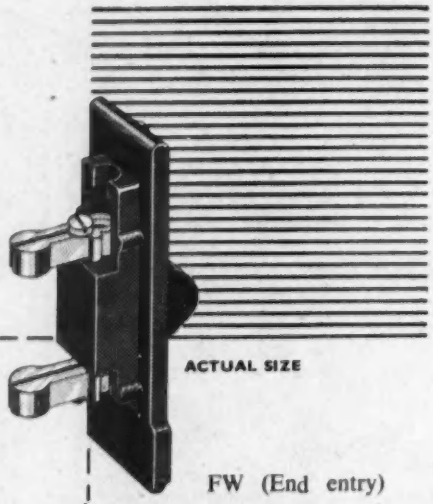

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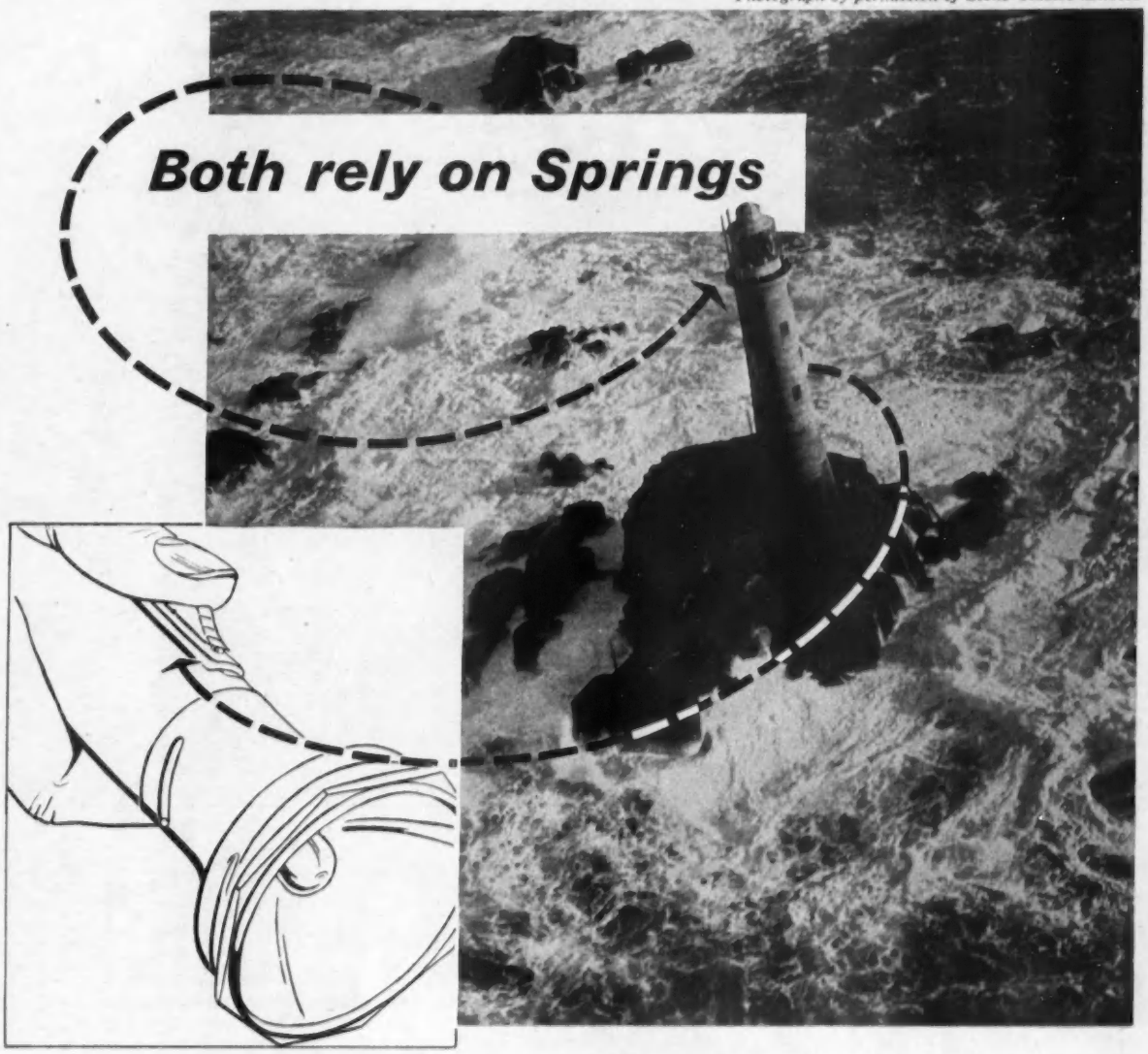

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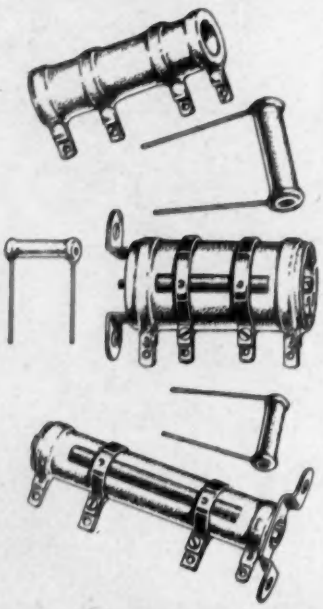

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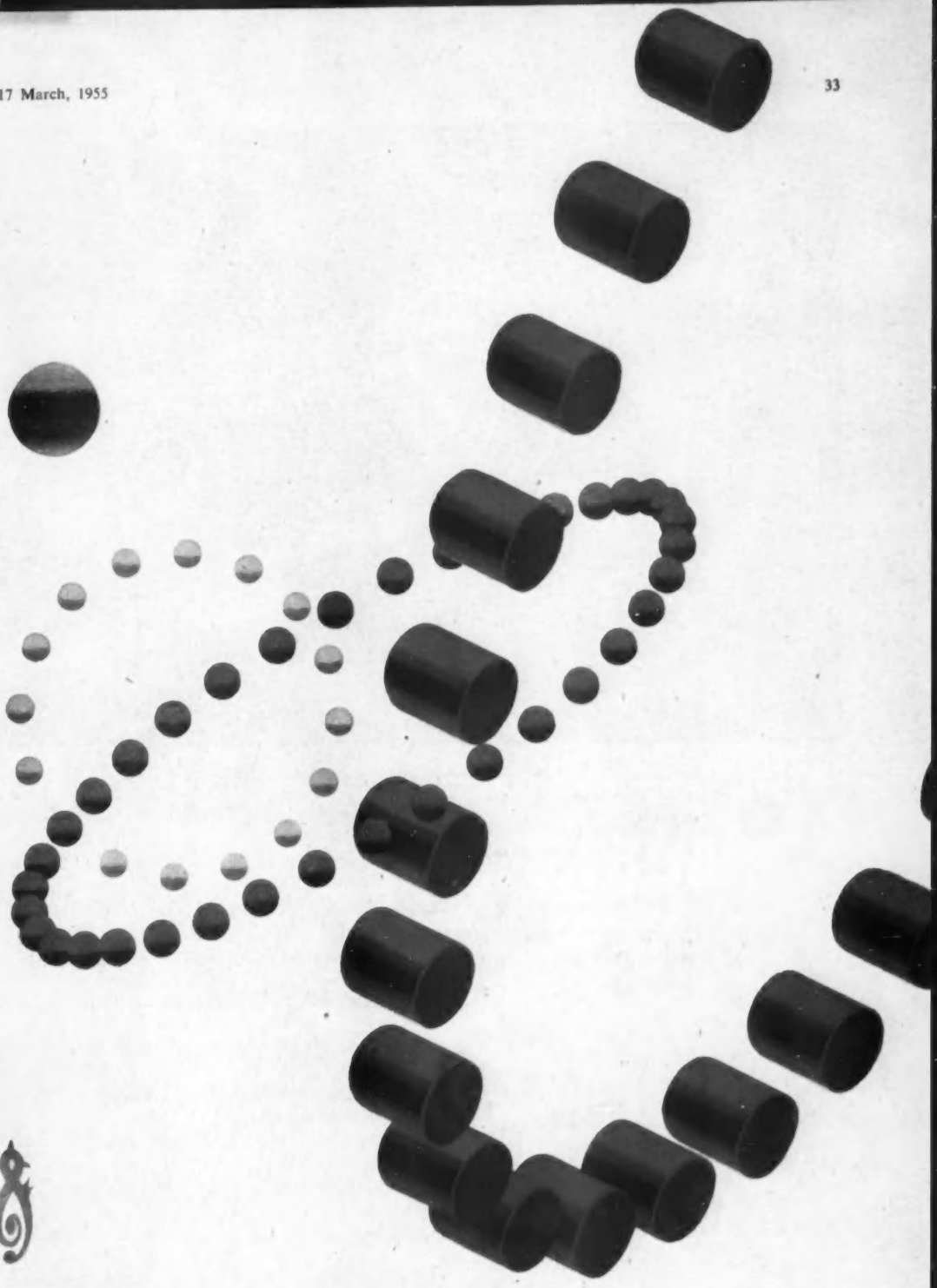

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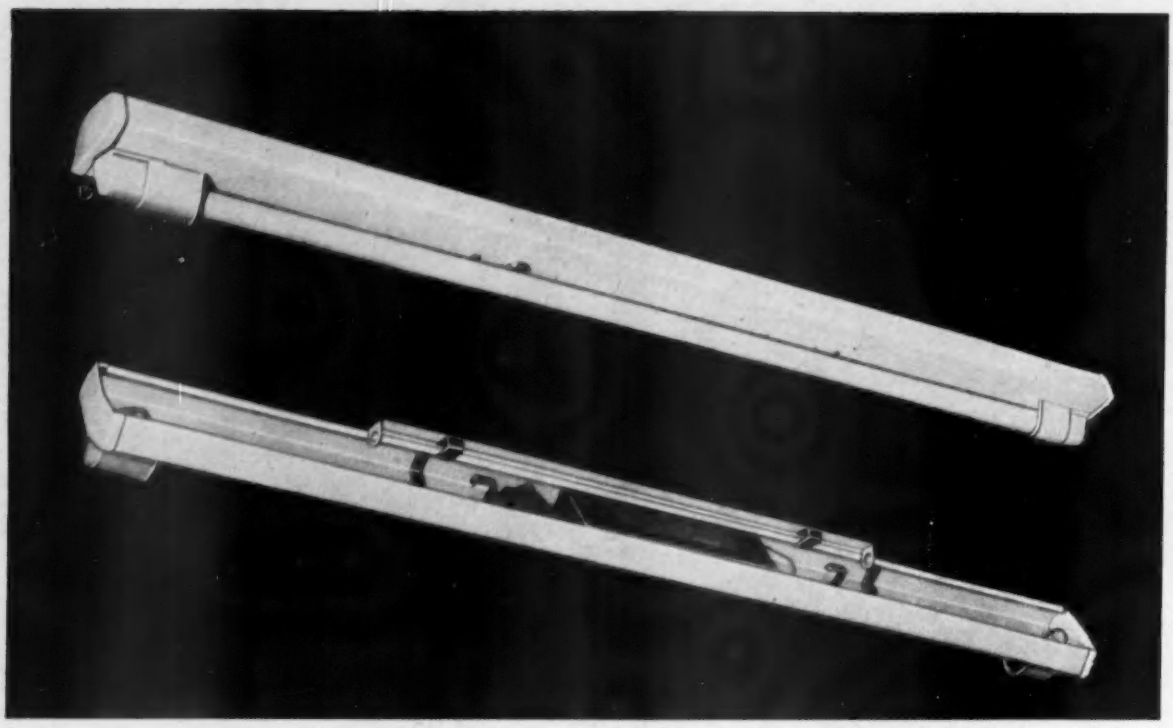

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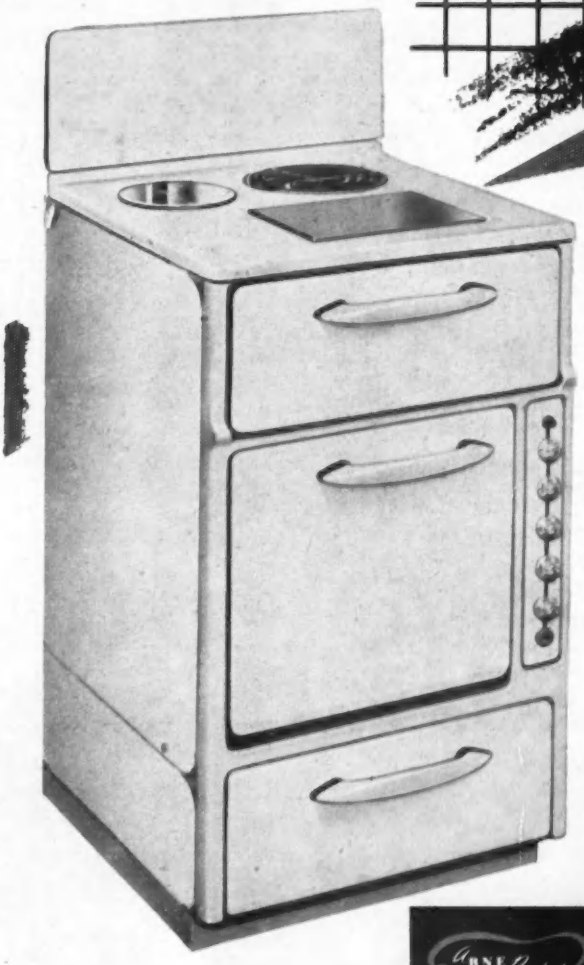

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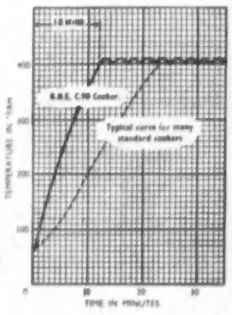

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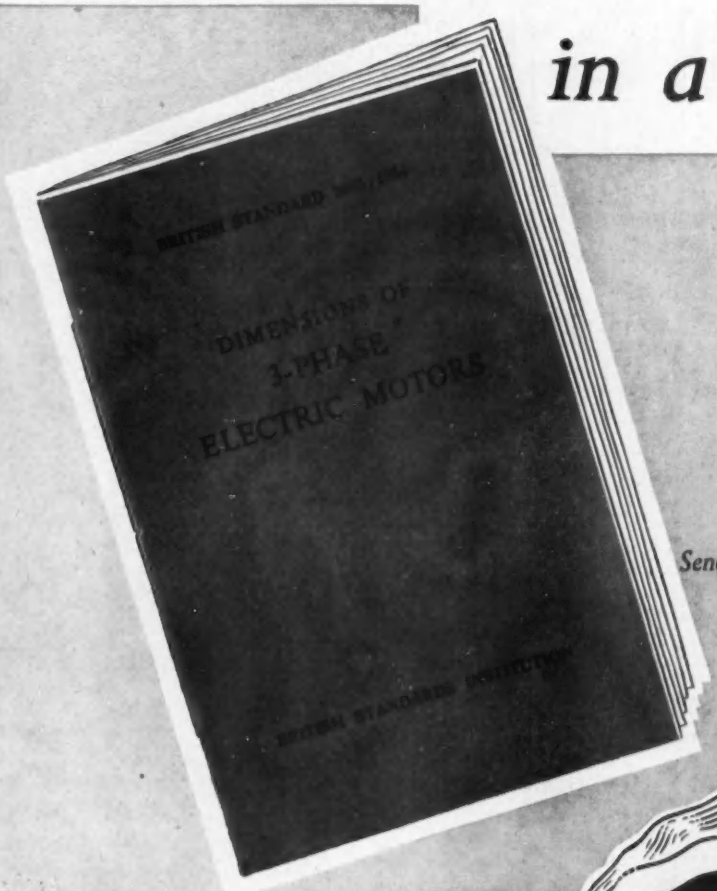

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Left:
View of Unit

Below:
View of Housing

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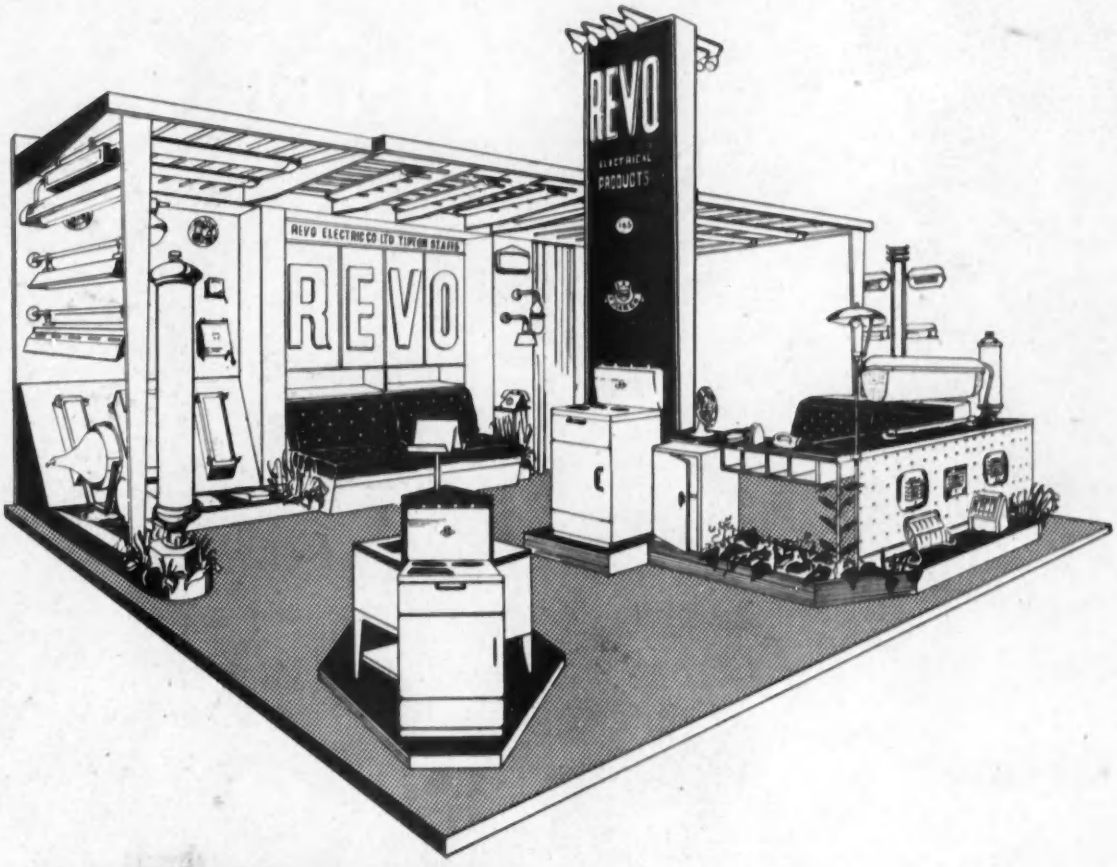

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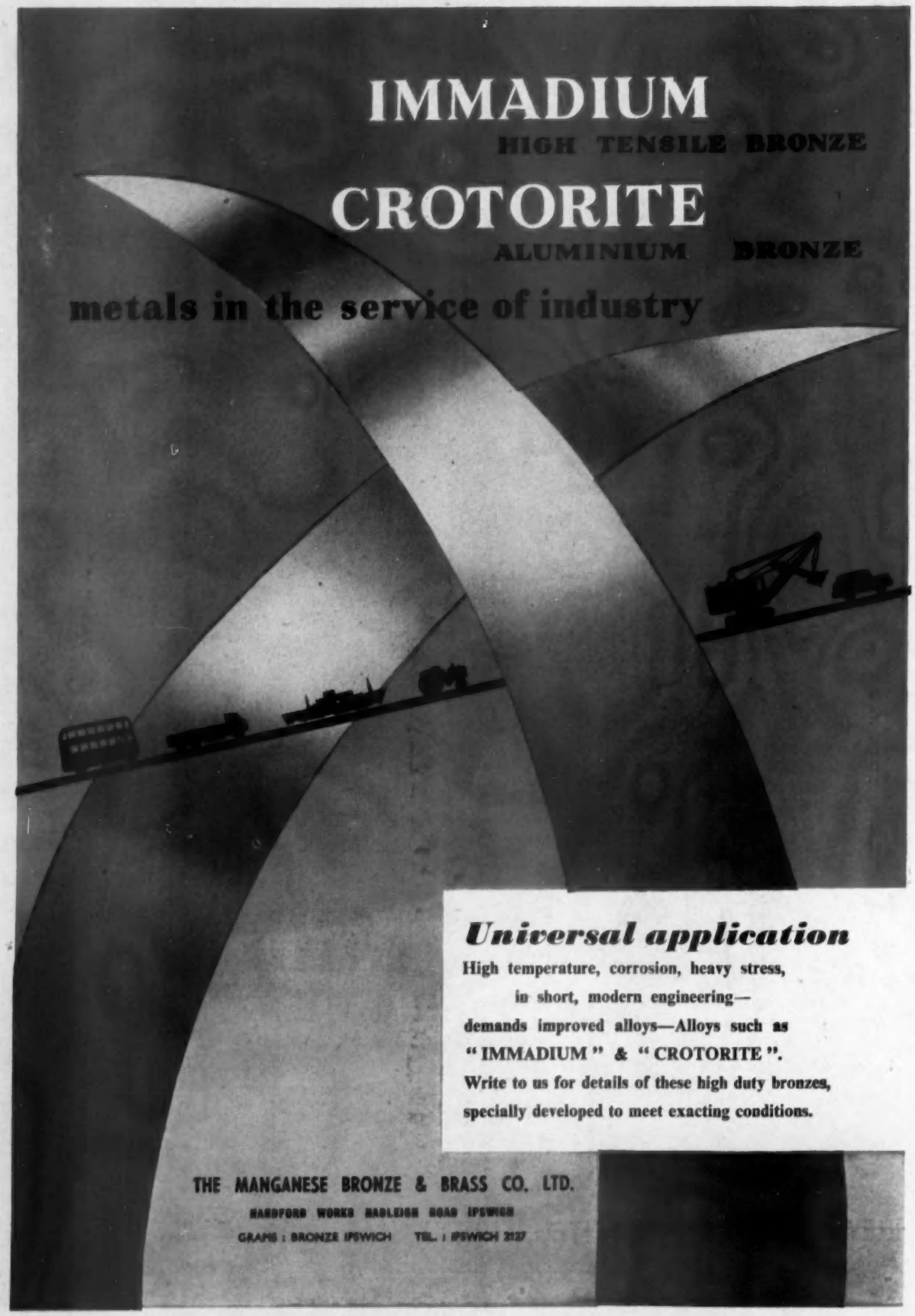

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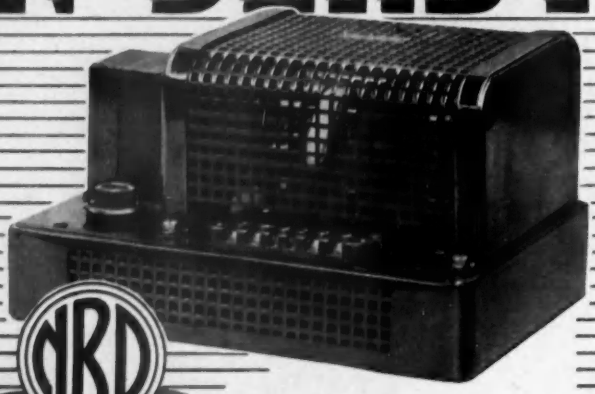

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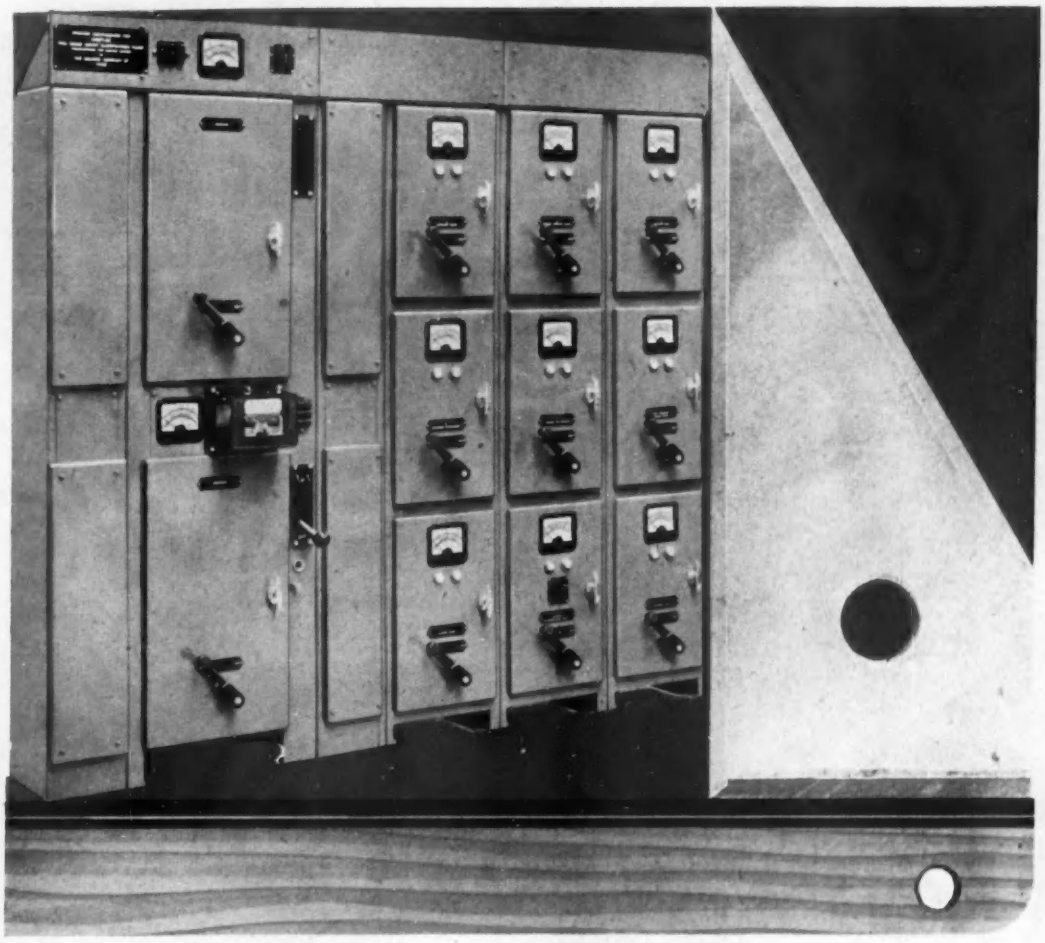

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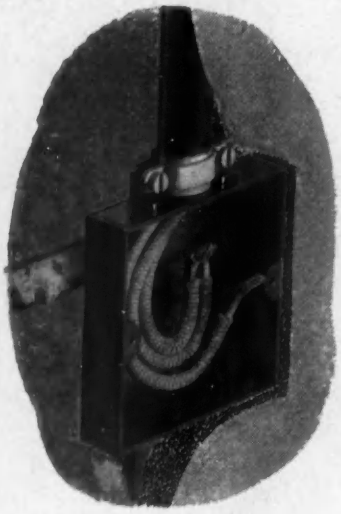

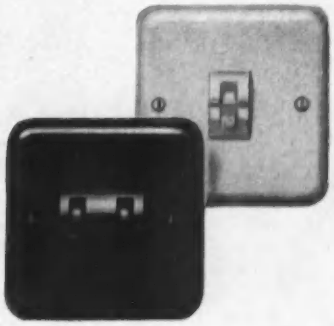

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7.5	1.82	2.58	3.16	3.65	4.47
10	1.58	2.24	2.74	3.16	3.88
15	1.29	1.83	2.24	2.58	3.16
25	1.00	1.41	1.73	2.00	2.45
50	.707	1.00	1.23	1.41	1.73
75	.578	.818	1.00	1.15	1.41
100	.500	.707	.866	1.00	1.23
150	.408	.575	.707	.818	1.00
200	.354	.500	.612	.707	.866
350	.260	.378	.463	.535	.655
500	.224	.316	.388	.447	.548
1,000	.158	.224	.274	.316	.388
1,500	.129	.183	.224	.258	.316
2,500	.100	.141	.173	.200	.245
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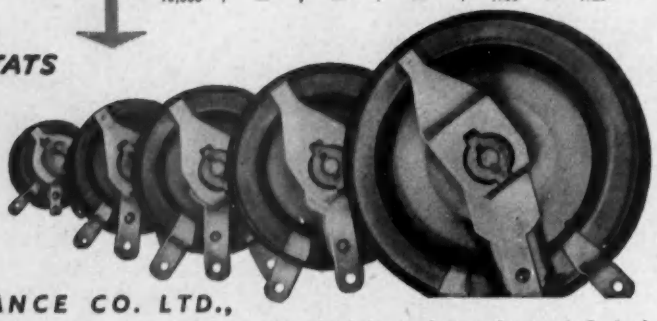

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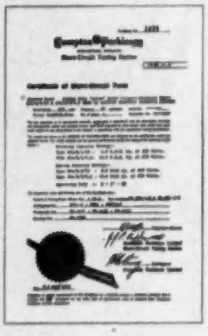

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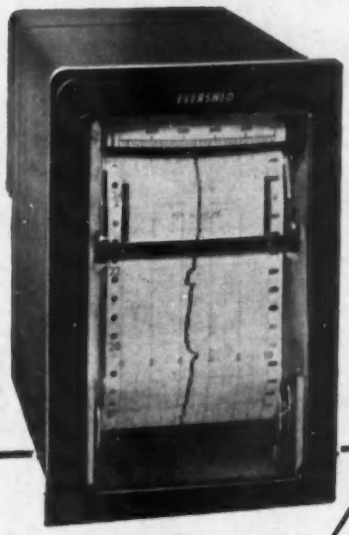

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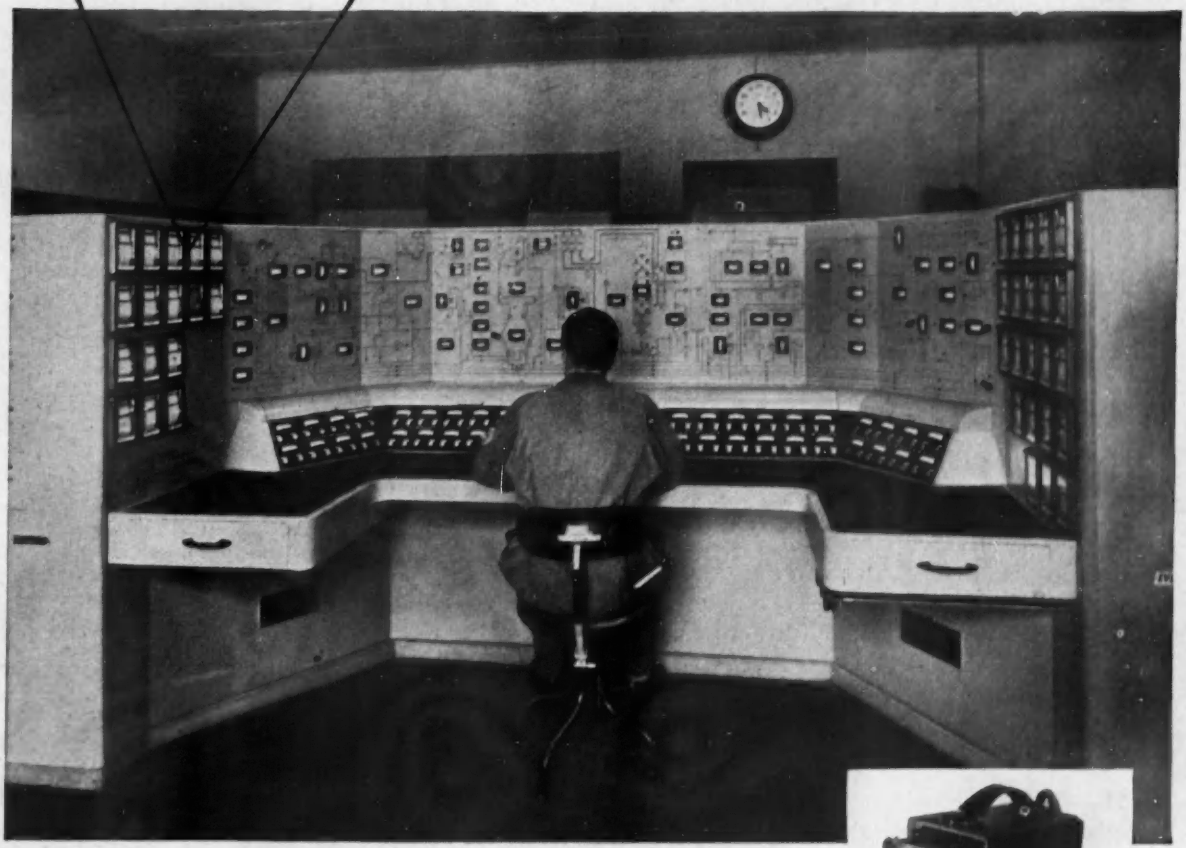
FOR FULL DETAILS, WRITE FOR PUBLICATION J 282



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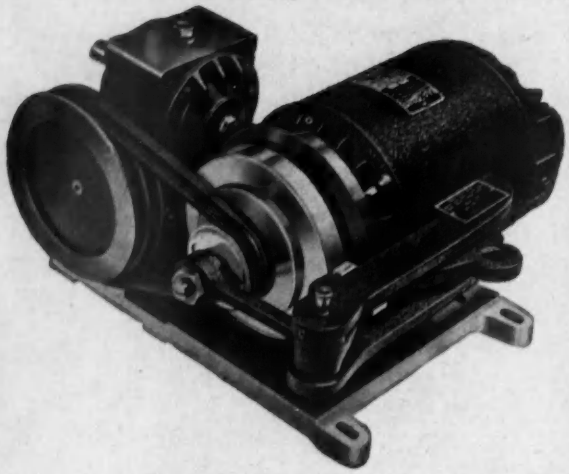

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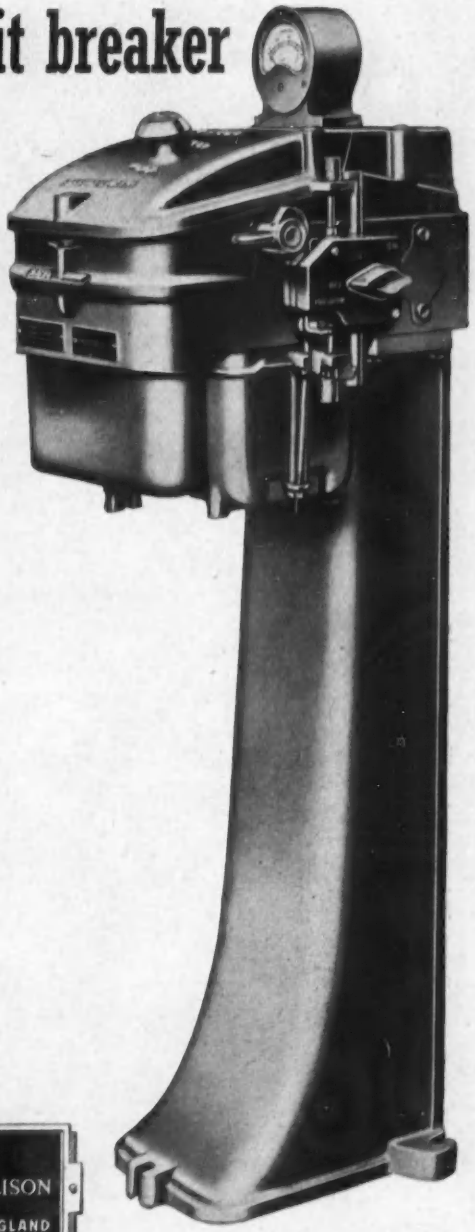

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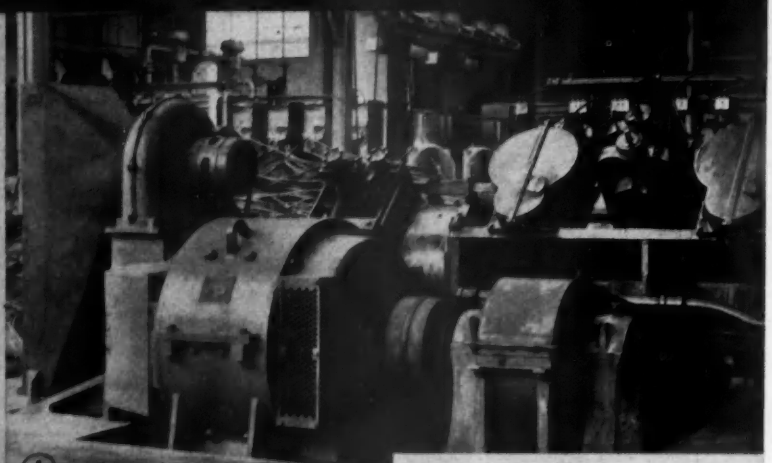

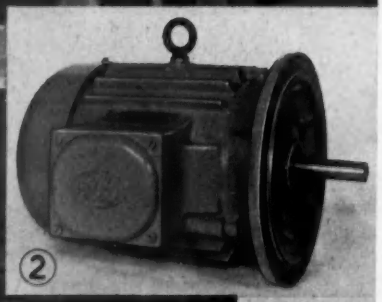

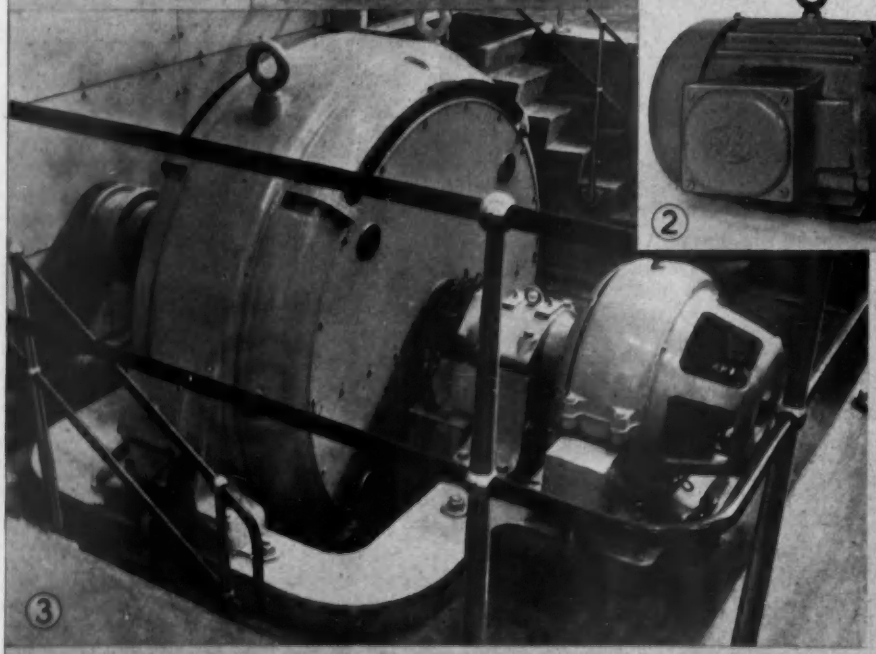

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D

STILL LARGER GENERATORS

Selection of optimum size of generating unit for any particular power system is a problem not readily amenable to clear-cut computation. But with the ever-increasing size of power systems shall we be faced with sets of 500 to 600 MW within the next ten years? This was the view expressed at the recent winter general meeting of the American Institute of Electrical Engineers where a paper presented by representatives of American General Electric advocated an optimum unit size of between 7 and 10% of the system capacity. The authors based this conclusion on a study carried out on a basic system expanding from 2,000 to 10,000 MW, and for the purpose of the calculation it was assumed that the forced outage rate would be about 2%, and that the rate of load growth would not affect the size of unit to be installed. As the paper was presented by representatives of heavy plant manufacturers it may be assumed that the unit figures of 500 to 600 MW are not beyond the capability of industry and although in the subsequent discussion, some of the authors' assumptions were challenged it is significant that members representing two of the larger systems in the United States agreed with the conclusion that the greatest practicable set sizes should be used within the limits of existing manufacturing capacity. Whether such sizes as quoted—500 to 600 MW—could be justified on the large interconnected system of this country is a different matter. At the moment the largest unit on order is 200 MW representing about 1% of existing capacity but it was only three years ago that a paper presented to the I.E.E. quoted 100-120 MW as an optimum economic size for the then existing conditions. Whatever opinions may be held on this difficult subject, it is nevertheless quite clear that the inevitable trend is toward sets of increasing size, and the limit is still far from being in sight.

MONOPOLIES ACCELERATION

One of the most persistent complaints in connection with the working of the Monopolies and Restrictive Practices Acts has concerned the seemingly over-long time taken for investigation and report. For the E.L.M.A. investigation, the period from reference to the Commission to publication of a report was 2½ years, and for the C.M.A. reference 3¼ years; and the operations of B.E.A.M.A. have been under investigation for just under three years, with no report yet published. During these periods, the working not only of the members of the leading trade associations, but of the whole of the industries involved, has been disturbed by the uncertainty induced

by a pending Monopolies Report, with its possible requirement of major adjustments in trading practice. Now there seems some hope of improvement. The 1953 amendment to the original Monopolies Act made possible a reorganisation of the Monopoly Commission's method of working, with small groups studying each industry and trade referred for investigation. As a result, the Commission now seems hopeful of reducing to little over one year the period between reference and report to the President of the Board of Trade. To this will be added some few months for private discussion before a report is made public. While this improvement in Monopolies procedure is welcome, it does not avoid the major upheaval in the industry concerned, and it leaves unanswered the challenge that enquiries are not conducted along accepted judicial lines.

RESEARCH EXPANSION

Few branches of technology or science are untouched by the activities of the Department of Scientific and Industrial Research, and its annual report is invariably an intriguing review of contemporary applied scientific activity, with plenty of new information for the electrical engineer. This year's report has a further claim to attention: it reviews the initial operations in the five year plan to expand staff by one-quarter, and the spending of the Department by one-fifth. The Government's intention to conduct such an operation was announced at the end of 1953, but its details are only now being finalised. The Department works, of course, on two levels. It directly controls some fourteen research stations and it administers as well the grants to industrial research associations. It is mainly the research stations that the present expansion affects, and none of these is primarily concerned with electrical power engineering. However, two establishments whose work is directly of interest are marked for early expansion, with new laboratories for fuel and mechanical engineering research. The former station is to have an immediate increase in staff in order that work on atmospheric pollution and on domestic heating may be speeded up; while the latter will be able to begin important investigations on heat transfer problems which may well obtain enhanced importance as nuclear generation is extended.

NEGLECTFUL MAINTENANCE

Routine in maintenance, with inspection at preplanned intervals has proved most efficacious in reducing the frequency of costly breakdowns in industrial electrical equipment. The concern of electrical maintenance engineers is usually to give maximum attention to plant without interrupting production: it comes as a surprise to find those concerned with automatic telephony equipment confessing that they have been making too many inspections, and advocating a return to the "let it alone until it breaks down" attitude. There is, however, a world of difference between the heavy current contactor operating in a grimy corner of a foundry and the lightly loaded selector switch running in an air-conditioned telephone exchange; but some of the automatic control gear that comes the way of the factory maintenance engineer is not so far removed from the latter type of plant. It is worth noting then that this seemingly retrograde step in the telephone world is not aimed solely at securing economy. Laboratory tests and field experience are quoted to support the claim that fewer breakdowns are the concomitant of fewer inspections. Power engineers have for many years had a somewhat similar approach to current carrying contacts and to some extent, to commutators. Now it seems that they would do well to avoid unquestioning acceptance of the idea that maximum frequency inspections are in the interests of the smoothest operation of the lighter types of automatic control equipment in their care.

INGENUITY IN CHURCH

Church lighting, like church heating, is all too seldom adequate for the job in hand. Lack of available funds usually prevents the use of special fittings which could give adequate light output, while the requirements of advisory architects and others in official positions rule out, on grounds of appearance, many standard models which could give the required control of intensity and direction. Thus, when relighting and rewiring of an existing church is decided upon, the result in most cases is a weak retreat to pendant clusters of bare lamps, in which inadequate illumination fights with glare. Such a situation is a challenge to the electrical contractor's ingenuity which can be accepted with advantage, as an article on a later page suggests. Modifications of standard fittings and the restrained use of floodlights and even fluorescent tubes can often give a more subtle as well as a more adequate lighting scheme, both without any increase in first cost. Suggestions along such lines are likely to find favour with anxious church councils with little capital to expend, and to secure general installation work as well as the lighting scheme, for the contractor who puts them forward.

U.N. AIDS SUPPLY INTEGRATION

On the agenda of the tenth session of the U.N. Economic Commission for Europe, which opened in Geneva this week, are the reports of various specialised committees, amongst them the Committee on Electric Power. From time to time individual projects of this committee are reported in the ELECTRICAL TIMES, but the content of the report emphasises rather the overall development of the committee's activities in the role of "honest broker" when international agreements on electricity supply are under consideration. The philosophy which informs this progress is well set out in the preamble to the report: "The problems raised by the production of electric power to meet the increasing demands of users generally have to be solved within each individual country, but international action is nevertheless needed to make national schemes fully effective." Perhaps the most notable example so far of the Committee's working out of this approach in practice is a four-country agreement for the export of electricity generated in Yugoslavia as a result of developing yet untapped hydro-electric potential. There are, as well, other export-import agreements and joint river exploitation schemes which bear witness to the helpfulness of the U.N. secretariat in navigation through the treacherous seas of international negotiation.

Meteor

Economy in Church Lighting

MODIFIED FITTINGS PERMIT GREAT SAVINGS

By A. H. TURBIN*

A CHURCH lighting installation is required to provide adequate reading and safety illumination, but the real criterion of its success is its ability to create a suitable atmosphere. In the churches of traditional design this may be achieved by the use of pendant fittings carefully designed to blend with the style of the interior, by concealed or indirect lighting arranged to reveal the architectural form or, by a combination of both, but in all cases the designer is concerned with the production of an appropriate aesthetic effect. In the case of the relatively few contemporary-style churches, a slightly different approach to the lighting design must be adopted. Modern architectural style embodies few decorative features and it is usually necessary for the lighting installation itself to provide the main decorative interest.

It is evident that church lighting is a matter for the closest co-operation between lighting specialist and architect, particularly in cases where the styling of pendant fittings is involved. The successful church lighting scheme of necessity must embody a somewhat delicate blend of optical, aesthetic and practical requirements, and for this reason the services of an architect who is also a lighting specialist can be invaluable. Very few catalogued lighting fittings are likely to be suitable and most architects will frown upon many of the designs which are labelled "ecclesiastical." The designer is, therefore, confronted with a choice between having a special fitting made to suit the requirements of the particular interior, or of adapting suitable standard fittings. For most churches the use of specially designed fittings is ruled out immediately on the grounds of cost. Fortunately, it is quite often possible, with a little ingenuity, to provide harmonious and efficient lighting by adapting suitable standard fittings of the simpler type.

Classification of Church Lighting

Before considering possible methods of reducing initial outlay on lighting equipment, it will be helpful to classify the main types of traditional church lighting systems. Although individual schemes vary considerably in detail design, most types can be included under one of four general headings.

(*a*) Lighting by means of pendant lighting fittings which direct all, or most of their light, downwards.

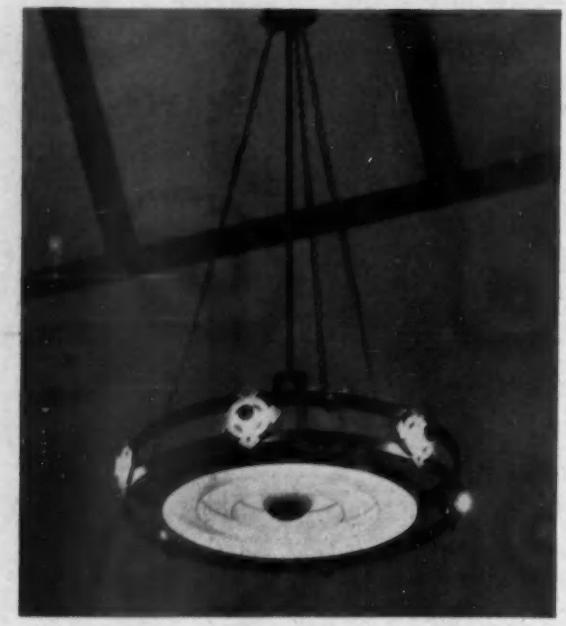
(*b*) Floodlights, or directional fittings, which are concealed in convenient positions and arranged to provide good coverage over the pews. In most cases fittings with fairly wide beam angles are used, so that there is a good deal of general diffusion and "overlap."

(*c*) Concealed or pendant fittings which direct most of their light upwards and rely on reflection from the ceiling to provide general illumination of an excellent diffused quality. Compared with the preceding systems this is relatively inefficient and cannot be employed effectively at all unless the ceiling and upper walls are light in colour.

(*d*) A combination of any of the above.

*Mr Turbin is with the Lighting Division of Philips Electrical Ltd.

Above. The cleverly adapted standard pendant fittings merge well with the architecture of this church at Woodford Wells, Essex



This close-up shows how standard fittings have been adapted to suit the style of the church interior shown on the first page

It will be noted that the above systems require fittings with some measure of directional control, particularly in the case of (*b*). Lighting of the traditional style of church by means of fluorescent lamps, or general diffusing fittings equipped with incandescent lamps, calls for considerable care, as apart from the difficulty of designing fittings which merge amicably with their surroundings, there is a danger that the highly diffused and non-directional quality of the light will nullify the form of architectural features, and detract from the appearance of the interior. The lighting should, as far as possible, be designed to permit clear vision of ceremonies. A higher illumination level is usually desirable in the sanctuary with special emphasis on the altar itself, thus providing a focal point of interest.

Points of interest at St. Thomas's

Photographs of the Roman Catholic Church of St. Thomas of Canterbury in Woodford Wells, Essex (Fig. 1) are interesting for two reasons. Firstly the pendant lighting fittings employed were adapted quite simply from standard commercial units, yet merge well with the style of the interior and provide efficient lighting over the pews. Basically, the fittings consist of Philips "Woburn" suspended louvre bowls, equipped with 300 W bowl-silvered lamps. The outer frames were specially designed to echo the character of the interior and they carry small "pygmy" lamps to provide subsidiary points of interest. Secondly, the installation is an example of supplementary indirect lighting by means of reflection from the nave ceiling. This is again effected in an inexpensive manner, namely, a double bank of 75 W spotlight reflector lamps placed on the clerestory window sills. The spotlights are separately switched and may be used independently to provide a low level of illumination when required. The method of adaptation used for the "Woburn" fittings might well be applied to several other types of commercial lighting fittings.

Fig. 2 shows a fitting made up from a few simple standard components. As mentioned earlier, the use of fluorescent lamps requires some caution, but where they are applicable, vertical mounting is usually the most satisfactory. This particular fitting has found favour with some church architects, and consists merely of three 40 W MCFB/U fluorescent lamps with appropriate tungsten "ballast" lamps. No conventional control gear is required so that the fitting is light and particularly simple to install and maintain. Fig. 3 is an example of an inexpensive multi-lamp fitting of contemporary styling. The fitting could easily be installed in churches of modern design but is, of course, unsuitable for the traditional church interior in its present form.

Concealed lighting systems

For concealed lighting systems, rather elaborate floodlights and projectors are frequently used mounted behind ceiling beams or other convenient architectural features. The efficiency of these fittings is excellent, but they tend to be heavy and bulky and, above all, expensive. Occasionally the physical dimensions of the church interior lend themselves to the installation of industrial fittings of vitreous enamel steel or prismatic glass, but the amount of control afforded is usually inadequate for any but low-ceiling churches. Also, the problem of glare can be troublesome, because of the rather wide cut-off angle and resultant lack of shielding. In the smaller churches, with which we are here mainly concerned, it is often possible to effect a very large saving in initial cost by careful use of internally silvered spotlights. They are light and compact and thus easy to conceal, and the internal silvering ensures that efficiency is maintained as long as the front glass is kept clean. Lamps with frosted front glasses are usually preferable as they provide better diffusion with less likelihood of glare, and also help to avoid "patchiness" in the illumination. The standard reflector-spotlights are 75 and 150 W (see Fig. 4) but a 500 W version is also available. There is no doubt that these lamps provide the lighting engineer with an extremely versatile and useful tool. Even in cases where they cannot be used successfully for general lighting purposes, they can often be used for supplementary indirect lighting (as shown in Fig. 1), and are eminently suited to highlighting of architectural features (particularly the altar sanctuary). Local lighting of the pulpit or lectern can be frequently provided in an efficient and unobtrusive manner with the aid of these lamps.

Fig. 2. (right) — Where fluorescent tubes are used, vertical mounting is preferable. In this instance they are supplemented by tungsten "ballast" lamps

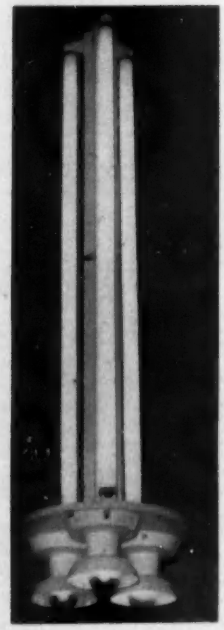


Fig. 4. A standard 150 W reflector spotlight with frosted-glass front is seen below

After examining these ideas for the inexpensive adaptation of standard lighting equipment, one fact becomes self-evident. It is that the need for expert advice from a lighting specialist is more important than ever, preferably one who is qualified to collaborate with the church architects. Adaptation does in fact call for greater skill and knowledge than original design, if harmonious appearance and optical efficiency are to be achieved. It is hoped, therefore, that electrical contractors and church architects will make the maximum possible use of the free advisory services provided by the lighting equipment manufacturers. Some manufacturers include among their lighting specialists one who is also a qualified architect, and to enlist the aid of such experts is the best way of ensuring that a new installation will give every satisfaction. Any economy which consists of drastic lowering of the illumination level or the use of inefficient and inadequate lighting fittings, is a false one. The I.E.S. recommendations of 5-7 lumens/sq ft are not excessive and have been laid down after consideration of all the relative factors. For example, the reading of hymn books frequently involves scrutiny of small type, and not all members of the average congregation have perfect vision. Even in churches where architectural lighting effects are not required, the designer has to ensure that all the normal lighting requirements, such as adequacy of illumination, uniformity, absence of glare are fully satisfied.

Contemporary Churches

In churches of modern architectural design, the recommended illumination level 5-7 lumens/sq ft may prove inadequate. The problems of lighting the contemporary style of church interior are perhaps more akin to those encountered in other fields. The fittings themselves may often play a major part in the architectural design and be of great decorative interest, but low levels of illumination will still tend to produce a rather lifeless and drab effect due to the simplicity of the interior aspect. For such interiors, up to 15 lumens/sq ft may be found desirable. There is frequently scope for ingenious adaptation of standard fittings and reflector spotlight lamps. Recessed fittings may be considered desirable and the possibilities of using standard reflectors in conjunction with simple frames and flush visor glasses are numerous. Here again expert advice can often point the way to a relatively cheap but effective lighting system.

Whilst worthwhile economies in the initial cost of the lighting fittings can often be made, in the electrical installation itself, the best materials will prove to be the most economical in the long run. The I.E.E. Regulations provide an excellent guide in this respect and any installation which uses them as a basis will certainly provide years of trouble-free service. Concealing the wiring is frequently a vexed question, as most architects are wary of extensive chasing and drilling of the masonry and timber. If conventional systems such as v.r.i. in conduit or lead-sheathed are to be used, the only recommendation that can be made is to avoid defacing the architectural features as much as possible. In some cases the contractor may find that the use of mineral insulated metal sheathed cable is the neatest proposition. Although rather high in initial cost, this cable may actually reduce overall installation costs as it lends itself to unobtrusive surface fixing and may be run round architectural and structural features, avoiding chasing and the extra time and cost involved when "tailoring" conduit runs.

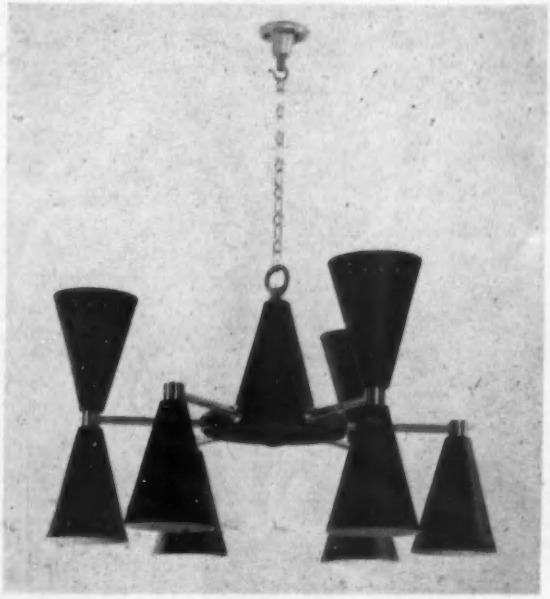


Fig. 3. An inexpensive multi-lamp fitting of contemporary design which could easily be installed in modern churches

The heading photo was provided by Philips Lighting Design Service. The architects were Archard and Hardy, F/A.R.I.B.A., John Layton, A.R.I.B.A.

SPARKOVER VOLTAGE AND ALTITUDE

THE problem of estimating air clearances and spark-gap spacings for transmission lines operating at high altitudes is considered in a recently published E.R.A. Report, "Altitude Correction Factors for Sparkover Voltages of Insulators and Rod Gaps," by A. Morris Thomas, Technical Report L/T 311, Price 10s. 6d. The report introduces the subject by dealing with the existing method of estimating temperature and density of the air, which has hitherto been based on data taken from the Smithsonian Meteorological Tables. This source may be regarded as superseded by "The International Standard Atmosphere" and the introduction of this, together with some recent experimental work on sparkover voltage as a function of air density makes it desirable to reconsider the correction factors for altitude which are at present incorporated in a number of British Standard Specifications.

The report gives a theoretical analysis of the problem, and correlates the results with experimental work, and concludes that the correction factors based on 3·5% per 1,000 ft leads to test voltages at sea level which exceed values based directly on the relative air density by about 3% for moderate altitudes, or alternatively, exceed values based on the 0·75 power of the relative air density by about 7%. In the opinion of the author, evidence is available which indicates that 3·5% per 1,000 ft in excess of 3,300 ft (the figure now adopted for British Standard Specifications) is unnecessarily high and that 2·5% per 1,000 ft would be satisfactory and lead to an appreciable saving on the insulation at high altitudes.

The report is illustrated with diagrams giving the variation of pressure, temperature and relative air density with altitude for a standard atmosphere with a sea level temperature of 20° C. A further graph gives a plot of sparkover voltage of suspension insulators with discs of 10 in. diameter and a spacing 5¾ in., and a similar plot is also given for sparkover voltage against rod gap spacing.

Finally curves were given of altitude factors (for heights above 3,300 ft) both for rod gaps and insulators, based on the 3·5% per 1,000 ft scale and also on the 2·5% per 1,000 ft scale. Copies of this Report may be obtained from the E.R.A., Thorncroft Manor, Leatherhead.

READERS' VIEWS

Correspondents writing under a pseudonym are asked to submit their names in confidence to the Editor

Apprentices and National Service

HAVING read the further comments of "Peregrin" on the subject of National Service, I still beg to differ. When I was quite a young man, someone pointed out to me that between the ages of seven and fourteen years, a boy *learns to learn*, that from fourteen years to twenty-one years, he *learns*, and that from twenty-one years of age onwards, he applies what he has already learnt. Those who have had experience in training boys will generally confirm that the years from sixteen to twenty-one are of vital importance in a young man's development, and that what he does in those years will largely determine his future career. Even if "Peregrin" is right in saying that there is a better chance of retaining a young man in the industry if he completes his National Service by the age of twenty, and comes back to his firm to complete his apprenticeship, what advantage is really gained? Because he has not completed apprenticeship training, he will be unable to do a tradesman's work in the Armed Forces, and will return to industry having forgotten nearly all that he learnt before being called up. Such a young man cannot possibly compete with others who have completed continuous apprenticeship training, and although he may remain in the electrical industry, does he really do proper credit, either to the industry or to himself?

I feel that those who deal with the training of apprentices have a great responsibility to the future, and the only real question to be answered is "which method will provide the best training for a successful career?" I would say emphatically that the vital years from sixteen to twenty-one should be devoted to training for a civilian career, and not for National Service. The only exception I would make is in the case of the young man who wishes to make his whole career in H.M. Armed Forces.

Call-up at the age of eighteen is incompatible with the basic principles of apprenticeship, for the Deed of Apprenticeship specifically lays down a period that is to be served with one employer, so that a lad may obtain a satisfactory training. This has been found the best method of training for many generations, and was commonly used in the training of craftsmen right back to the Middle Ages. Can we honestly say that employers today have more understanding of human nature than those who have taken part in building up our present civilisation?

R. A. Marryat, B.SC., A.M.I.E.E.,
Marryat and Place Ltd.,
LONDON, E.C.1.

Portable Tools

HAVING read Mr Leighton's letter in the ELECTRICAL TIMES of 3rd March, I feel that he must have missed the point I am trying to emphasise. I am not against spending money for the safety of operatives in dangerous situations, but I think that there is more than one way of spending it. If one is prepared to buy safety, then the most effective way is to install safety devices and have these tested regularly in addition to the rest of the installation.

A statement I made was that daily tests will not prevent a certain type of accident. What is required is automatic isolation when trouble occurs, and the monitored earth circuit goes a long way towards attaining this ideal. I think that this system can be developed to give greater reliability and safety. Any added complications will tend to deter interference by handymen and other incompetent persons.

With regard to flexible leads, I am of the opinion that there is no simple and at the same time really reliable test of earth core continuity, and that therefore, automatic isolation is very important.

It will be apparent from these remarks that I place great reliance on protective devices, but I regret that Mr Leighton has not mentioned them.

B. G. Palmer,
ILFORD, ESSEX

Shift-Work Studies

VARIOUS references have been made in recent years to the subject of qualifications and although it would be absurd to minimise the importance of technical education, the position of the shift worker in this respect should be clearly understood.

May I go back five years and refer to your editorial of 9th February, 1950, in which mention was made to shift workers and classes, viz—"It is a mistake to assume that shift workers are automatically debarred from attending classes. It is true that no directive has been issued by the B.E.A. on this matter, but it seems to be generally understood that shift rotas shall be arranged with a sympathetic eye to those with ambitions to qualify."

Since the B.E.A. adhere strictly to the N.J.B. agreement in which sympathetic eyes are not included, all contingencies such as sickness and resignations, etc., are covered by the normal shift complement, consequently attendance at classes can drop from 80% to below 60%.

Again referring to your statement—"The man at the top has usually a keen sense of responsibility towards his shift staff and their needs in this direction." This is a completely erroneous impression and far removed from the facts. Such consideration has always been conspicuous by its absence. Furthermore, any reference in literature to education and training does not apply to shift staff personnel.

To sum up, it is clear that study under shift conditions is far from easy, and if there are any aspirants to higher education left who have any doubts in the matter, it would be well for them to realise that no help, consideration, interest, encouragement, or even congratulations on success can be expected. Acute frustration under short staff conditions is inevitable, and difficulties due to absence from lectures will follow. In the circumstances, good luck as well as determination is necessary to carry on. Many throw in the sponge not through lack of interest but for obvious reasons.

"Star-Delta,"
LONDON.

Flue Dust Emission

RECENTLY published by the British Electricity Authority is Memorandum/GO/0719/ET which contains the proceedings of the Conference on Flue Dust Emission, held last year at the Divisional Headquarters of the South Wales Division. The memorandum includes apart from the Chairman's opening and closing remarks, the nine addresses and the discussions which took place at that conference. The topics include dust sampling and measurement, collector performance, dispersion of chimney emissions and a description of the difficulties which arose at Upper Boat station.

GUIDE TO THE FITTING
OF SUPPRESSORS
FOR TROUBLE FREE OPERATION
OF ELECTRICAL APPLIANCES

Photo by courtesy H. M. Postmaster General

Suppressing Radio Interference

By Anthony P. Hale, GRAD.I.E.E.*

THE recently announced regulations on the interference suppression of domestic electric appliances will, it can be expected, have the effect of making the public conscious of the need for suppression, and the demand for this type of work will increase heavily. In the past the engineers of the General Post Office have dealt with a very large amount of this work as a side line to their Interference Investigation Service, but with the inevitable rise in the amount of true investigation these engineers will now have, they will not be able to carry out the actual fitting of the filters (or suppressors) to appliances.

In the past the suppression of radio interference has been treated on an entirely specialist basis, but with the increase in work it is essential that any one concerned with the manufacture or maintenance of electric equipment should have at least a basic idea of the techniques involved. It is only possible to give an outline to the problems in a short article, and, in any case, much of the specialist work on suppression demands a variety of expensive pieces of equipment which will never be available in the average electrical workshop. This, however, will not prevent the trade doing that part of the work for which they are best fitted; the supplying and installing of the necessary filters and the giving of sound advice to the public on all the problems involved.

The Cause of Interference

Consider the case of a switch breaking a circuit carrying d.c. to a lamp. When the switch opens the current ceases more or less abruptly, and the voltages across the switch rises in like manner. If the switch operates without any appreciable arcing, the time of decay of the current will be very rapid, maybe only one hundredth of a microsecond long, and this "step" will contain very high frequency components, in the case of the time mentioned at least up to fifty megacycles/second. Of course, switches very rarely operate without arcing, and in the case of circuits carrying power, or containing inductance, the arcing may be very considerable and last an appreciable time. This fact does not ease the problem at all however, as during the arc the current is not decaying in a regular manner, but is undergoing small and rapid fluctuations, or, in other words, the wave form of the arc contains a very widespread assortment of frequencies covering a band from a few cycles per second up to many millions. The exact range, and frequencies at which the most energy is created, depend on the circuit and contact parameters.

Broadcast and television transmitters work on frequencies between 150 kc/s and round about 200 Mc/s, and it is easy to see that the opening of a switch may generate frequencies in the same range as that used by these transmitters. It must not be forgotten that other radio installations used for communication and defence operate on frequencies both inside and outside this band and interference may also disrupt these services. The power generated at high frequencies in the switch circuit is obviously very small, but as a television set will operate satisfactorily with a signal of 100 microvolts/metre at its aerial terminals—something like 10^{-10} W—the interference does not need to be unduly large to cause trouble.

Plain switches, of course, do not normally cause complaints. One "click" or flash on a TV screen is soon forgotten. The trouble comes when the same effect is repeated rapidly over long periods, such as at the commutator of a motor or the contact breaker of an electric bell. This "switching" interference, whilst only one of a number of causes is nevertheless the one giving most of the trouble.

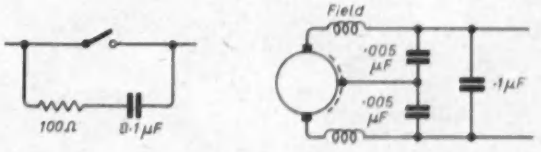


Fig. 1. (Left) "Arc quench" circuit which not only reduces interference from switches and thermostats but lengthens contact life. If television suppression is also required, a t.v. choke has to be inserted between each contact and the connection to the R-C circuit. Fig. 2. A circuit effective on long and medium wavebands used with an appliance connected by a two-core flexible. Capacitor values are absolute maximums for a portable appliance

* The Author is with Belling and Lee Ltd.

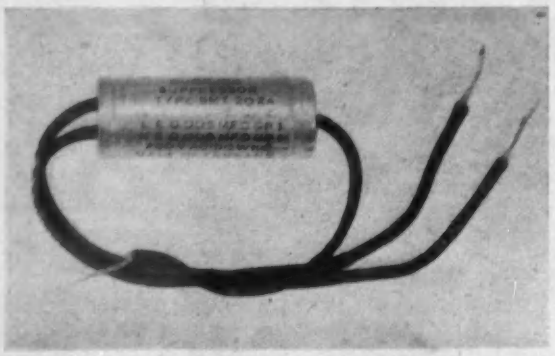


Fig. 3. A capacitor used in the circuit shown in Fig. 2 (by courtesy of Dubilier Condenser Co.)

Other causes include any device intended to produce a spark, such as the ignition systems of cars and the ignitors of oil furnaces. The flashover on a cracked insulator will also cause trouble. Corona from high voltage circuits, and all discharge lamps including fluorescent tubes produce interference, as also do poor circuit connections or even the touching of wiring conduits against other pipes. Trouble of a different nature may be caused by devices intended to generate radio frequencies, such as diathermy equipment in hospitals, radio frequency heaters and, exceptionally, breakthrough from other radio transmitters.

Coupling to Receiver

High frequency voltages induced between the line and neutral wires of a supply system are coupled readily by circuit capacities to a line to earth path as well. It is thus possible to detect interference voltages either between conductors or from conductors to earth. These voltages are carried along the main wiring for considerable distances and may in bad cases still be appreciable at a quarter of a mile away. The degree of attenuation of the interference voltages increases with their frequency, and on the television band, that is above 40 Mc/s, mains conduction is only important over a few yards. If the mains leads feeding a receiver have impressed upon them interference voltages, it is quite easy for these to be transferred to the input circuits of the set, especially in the case of a.c./d.c. models without mains transformers.

Coupling by radiation also occurs. The appliance and its mains lead act as a transmitting aerial, radiating an interference field which is picked up by a receiver in just the same manner as a radio station. Radiation is extremely important at higher frequencies as on television, but also causes trouble on medium and long wave bands. Interference can also be radiated by an appliance, picked up by, say, telephone wires or gas pipes and then re-radiated from these at quite considerable distances.

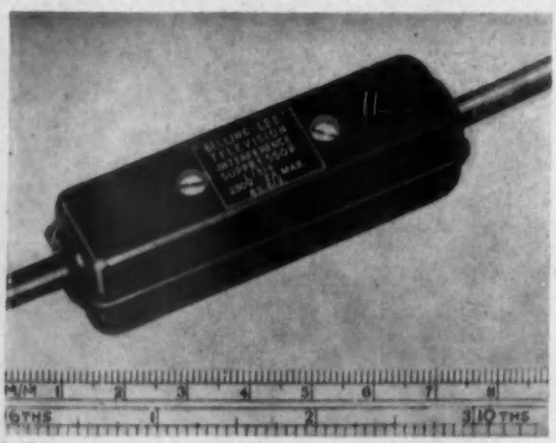


Fig. 4. A filter suitable for incorporating in flex leads, for suppressing TV interference

What now is the method of curing interference? The first, and best, treatment is by prevention either by using equipment which is inherently interference proof or by suppressing at source apparatus liable to cause trouble. Squirrel cage motors or other electrical machines which are incapable of causing a spark can be considered absolutely safe from this aspect, with the exceptions noted below. Other devices on the clear list are true a.c. bells of the type having no interruptor, all gas-filled (not vacuum) filament lamps, and resistive heaters.

Even though these devices are of themselves blameless, the switches controlling them, especially if of the thermostatic type, may cause severe interference as also may faulty wiring. Of great importance when the prevention of interference is being considered is the fact that a well-built, well-maintained machine is far less likely to cause trouble than is a badly-made, ill-maintained one.

A second method of treatment is at the receiver. There has been a most regrettable tendency recently, due to the high sensitivity of modern radio sets, to omit the use of a good aerial or earth system. Receivers used in this manner are much more susceptible to interference, due to the signal being picked up by a small indoor aerial, which may even be inside the receiver cabinet, and which is coupled very tightly to the mains wiring. The aerial must therefore pick up a large amount of noise from the wiring. This criticism of indoor aerials does not apply to

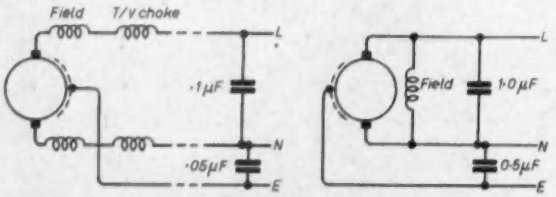


Fig. 5 (left). Circuit giving suppression on long, medium and television wave bands, the TV chokes being of the type shown in Fig. 4, and which must be inserted into the supply lead within 6 in. of the motor. The capacitors must be fitted in the plug. Fig. 6. With a motor permanently installed and earthed, larger and more effective capacitors may be used, connected directly to brush gear or terminal block

frame or loop aerials used on long and medium waves, which are directional and can be often arranged to discriminate against interference, or to indoor television aerials, providing all these types are used correctly in a district where the wanted signal is of adequate strength.

No user of a poor aerial can reasonably expect others to suppress appliances to unduly rigorous limits when the obvious cure would be a good receiver installation. The need for good aerials is of greatest importance in built-up areas, where the general noise level is high due to the multiplicity of interference sources. Special screened feeder aerial systems are available for use in bad cases. A good earth is always essential and this should be a direct connection to either a driven earth rod or a metallic rising main water pipe. The earth of an electrical installation should not be used for radio purposes, as it itself may carry high interference voltages. Incidentally, the aerial and earth terminals provided on receivers should always be used and no attempt made to connect directly to the radio chassis.

In many cases the Post Office engineers will locate the particular appliances causing interference, but it is as well to know, in outline, the method of locating an offender. The correct technique is to take measurements of interference voltages at the terminals of the suspected appliance, and the field radiated by it at a specified distance. This however, necessitates the use of measuring sets which are in effect highly stable calibrated receivers with facilities for measuring output voltages, and whilst used by the G.P.O. engineers and other specialists, are not normally available. However, much useful information can be gained from a normal radio or television set operating from a satisfactory aerial of a type used in the district. If the receiver is operating on a local station and within its service area, then interference from appliances in the house should be suppressed so as not to cause noticeable interference. Tests of this nature are obviously very crude and may give misleading results when working within a few miles of the transmitter or out of its service area, but they do in the majority of cases show which items need attention.

Identifying Interference

The nature of the interference heard or seen varies with the type of machine producing it, and the source can often be identified by this means. It is as well to be familiar with these effects and this is best done by carrying out simple experiments. There are, however, a number of books giving illustrations of interference patterns which may be of help.

Do not forget, however, that a television set will sometimes interfere with an adjacent radio, producing a high pitched whistle, due to radiation or conduction from the line time base in the television. The cure here is normally to space the receivers by about ten feet. Other whistles heard on radio are caused by "beats" from adjacent stations, and wandering diagonal lines or herring-bone patterns on a TV set are caused by interference from nearby powerful transmitters, r.f. heating or even nearby receivers. A somewhat similar pattern though normally restricted to one or two horizontal bars on the screen, can be caused by vacuum-type filament lamps and these somewhat special sources must be remembered.

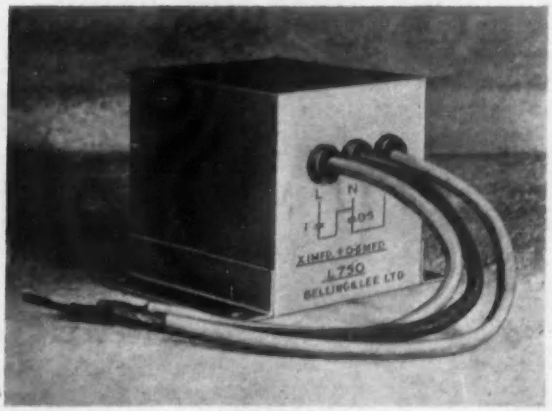


Fig. 7. A capacitor unit suitable for use with permanently installed motors and connected as shown in Fig. 6

The interfering appliance is a box generating r.f. energy, feeding this energy down its supply leads, whilst also radiating from itself and these leads. The basis of suppression is either to prevent the interference being generated, or to confine it to the machine. Generally little can

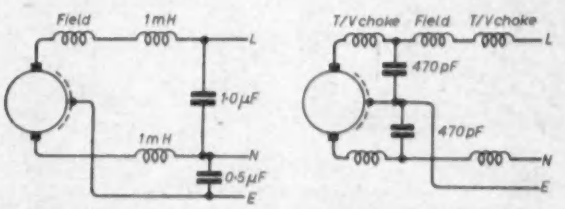


Fig. 8 (left). Since a series motor with only a single field winding, as shown, causes more difficulty in ensuring adequate suppression than a split field machine (as in Fig. 2) the more effective filter shown here is required. If the motor is not permanently earthed and used on an a.c. supply, the capacitors must be reduced to the Fig. 2 values. Fig. 9. In some cases, complex filters will be required to secure adequate T.V. suppression, this arrangement being suitable for use with hairdryer or portable drill. Values of capacitors are correct for Band I; for Band III they should be 100 pF and correct chokes used

be done to limit the interference by prevention, other than by the use of interference-free apparatus. Adjustment of brushes and commutator cleaning on a motor are often useful and fitting of a standard "arc quench" circuit (Fig. 1) on contacts reduces the arc and thus the interference. Generally it is necessary to use some form of filter external to the machine.

To remove a voltage either the circuit can be broken, or a short can be applied. As the interference voltages are at very much higher frequencies than the supply either method can be used without appreciable effect on the power circuit. A capacitor across the terminals acts as a low impedance at high frequencies. The size of the capacitor is important, however, both from a safety aspect and because capacitors have leads, the inductance of which makes the capacitor resonate at a certain frequency, above which its impedance increases. In order to widen the working range of this type of suppressor, capacitor leads must always be kept very short. Bushing capacitors form an exception as they do not resonate and remain effective at all frequencies.

As a capacitor acts as a short to r.f., it will increase the current in the machine-capacitor circuit. Any increase of current increases radiation of energy, thus the capacitor must be very close to the machine to avoid long leads acting as an aerial. This is of very great importance at higher frequencies, as used for television, since on the existing Band I service, the ideal aerial length is only some five feet, whereas on the future Band III frequencies only one foot three inches is required to give ideal radiation conditions. Obviously capacitors used on these frequencies, unless right inside the machine, and sometimes even then, can make things worse.

Fig. 10. Chokes for use in circuits as Fig. 5, for long and medium waves

To achieve an open circuit either an inductance or a resistance can be inserted in the supply leads. Normally the resistor is inadmissible unless its effect on the mains circuit can be

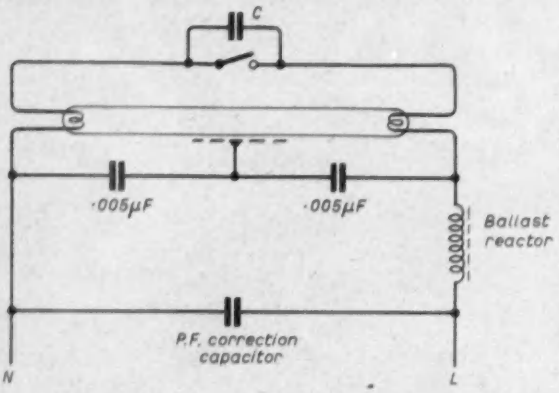


Fig. 11. Filter used for a fluorescent lamp. Capacitor C is normally fitted across the starter switch

tolerated, as in a sparking plug lead on a car engine or furnace ignitor. The inductor is employed in most applications as its impedance can be high at radio frequencies but low on power frequencies. Again its value is important. Due to stray capacity it will resonate at some frequency, at which it has a very high impedance and above which its efficiency decreases. Also the current rating must be sufficiently large and its loss at power frequencies acceptable. The inclusion of an inductor decreases the r.f. currents in the circuit so reducing radiation, and is normally used at the higher frequencies or where the filter must be placed at some distance from the machine.

It frequently happens that a filter using only one type of component does not give sufficient insertion loss, in which case a network using both inductance and capacity is used, in extreme cases several L-C sections may be needed. It is impossible to illustrate all the varieties of filter used, but some of the more common types are shown and these will be effective in the majority of cases for suppression of domestic appliances.

It is necessary to emphasise that the position of a filter must be considered. It is possible where protection on long and medium waves only is required to use a capacitor at the flex plug, providing the lead is not unduly long, but if the filter is expected to work on short waves or television then it must be placed close to the motor and in most cases having an inductance on the machine side. It is exceptional to find a unit effective over all frequency ranges, but different units may be combined to give the desired result. It is also possible to use separate filters placing the long and medium wave unit, necessarily the largest, away from the machine whereas the television suppression components which are small, may be built in.

Fig. 12. The circuit of Fig. 11 would use suppressor capacitor of this type

Safety

As apparatus may need to be modified, and in any case mains connections have to be made, it is essential for all the work to be done in accordance with the highest standards and nothing which would be condemned on other occasions should be allowed. As an example it is often the case that the removal of the earth connection to a portable appliance will reduce interference, due to the reduction of the line to earth radio frequency currents. There is no need to emphasise that short cuts such as this must never be used.

Components used in filters must also be of the highest quality. Insulation and current-carrying capacity of inductors and working voltage of capacitors must be suitable for the circuit conditions. It is sometimes convenient to use a separate fuse in a filter employed on low current applications where the protection afforded by the normal sub-circuit fuse may not be adequate.

Capacitors must be of the best types normally obtainable, preferably in metal or bakelite cases, and always of the specified voltage rating which is 2,250 V d.c. test when the unit is used on a supply not exceeding 250 V, r.m.s., 50 c/s a.c. or 500 V, d.c. Specialist advice must be sought where the voltage or frequency exceeds this value or where the unit is to be run at a high temperature. Normally the maximum for standard ratings on a capacitor is 70° C. Apart from selection of capacitor values for the circuit concerned a limit is placed on maximum size for safety reasons. The charging current of even a small capacitor can produce a severe shock or even prove fatal, and the values laid down in B.S. 613 must never be exceeded.

Fig. 13. Two sizes of r.f. chokes for suppressing television interference

Selection of Filters

In many cases manufacturers of appliances make recommendations on the types of filter to be fitted, or can supply suitable units. In these cases their advice should be followed. Again some manufacturers require their machines to be returned to them for suppression, this being especially the case where components have to be built in, as structural modifications may be necessary. It is important to make sure that no guarantees are invalidated when fitting filters. If no filter is recommended by the makers then the standard types illustrated must be tried, starting with the simplest or most convenient to fit and adding complexity until the desired results are obtained. Units constructed to meet all normal requirements are available from suppressor manufacturers and the use of these is obviously more convenient than individual construction. Also with these manufactured units there is no fear that any of the regulations will be broken. After filters have been installed it is suggested that the appliance be permanently labelled to avoid the components being removed when the item is returned for normal repair, as at this time the need for the filter may not be fully appreciated.

THE TORONTO SUBWAY

HIGH-SPEED URBAN TRANSIT SYSTEM DESCRIBED AT I.E.E.

WE have already had occasion to deal with certain aspects of the new Toronto underground electric railway. A comprehensive paper, however, dealing with the electrical details of the system has now been presented to a general meeting of the I.E.E. The author was Mr Frank W. Roberts and the full title of the paper was "The Electrical Equipment of the Toronto Subway Cars." Mr Corson read the paper in Mr Roberts' absence.

As the design of car is naturally bound up with the traffic conditions the paper began by giving a brief background of the traffic transport situation in Toronto. With a population of about 1¼m inhabitants, and a motor car density of one car for less than every four persons, surface transport was rapidly becoming congested, a situation which was aggravated by the predominance of traffic flow in a north-south direction. The decision was therefore taken to relieve the heavy surface traffic by the construction of an underground system which would be capable of handling peaks of 40,000 passengers per hour on the north-south route (Yonge St), and 15,000 passengers per hour on the east-west route (Queen St). Of these two schemes the Yonge St section is now in operation. This has a route length of about 4½ miles and has twelve stations in its length. The track runs partially in subway, partially in cut-and-cover and partially in cuttings. To retain consistency, the existing gauge of 4 ft 10⅞ in. which was already in use for the surface tramway system was retained.

The current collection is by third rail, top-running, at 600 V, using 150 lb/yd third rails. Signalling is by colour light, 3-aspect, supplemented by automatic train stops and designed for a density of 40 trains/hr.

Rolling Stock

Each car is motored and has a single driving cab, and pairs of cars are semi-permanently coupled with the driving cabs outward. One of each pair is fitted with a motor-generator with battery, the other carrying a motor-driven air compressor. Thus any train must be made up as an even number of cars. Up to four pairs can be coupled together to suit the station length, but at present trains do not exceed three pairs. Under four-pair operation, the starting current per train is 4,800 amps (motors in parallel).

Each car has four traction motors so that every axle in a train is powered. The drive is through cardan shafts to gear boxes, so that the axis of the motor shaft is parallel to the length of the train. The construction of the motors is conventional, and each pair is permanently connected in series. Output data is 68 h.p. per motor (1 hr rating) with a current of 212 amps at 275 V. Considerations which led to the adoption of the cardan shaft, hypoid gear arrangement in preference to the more usual nose suspended motor were the simplicity of obtaining a high gear ratio in small space, ease of frame mounting, reduction of shock and vibration and reduction in weight of motor due to its higher speed, a result of the higher gear ratio.

Track Supply

All major items of traction control-wear are electro-pneumatically operated and are housed in a single equipment case mounted beneath the underframe of the car. A camshaft driven contactor system has been adopted and a choice of three acceleration rates is available to the driver.

Five substations feed the track, and these substations receive their primary supplies from a 13·5 kV distribution system at 60 c/s. The substations contain pairs of 6-phase mercury-arc rectifiers to give the effect of 12-phase operation. Each rectifier is a 1,250 kW unit and the substations are rated at 5 or 2½ MW; with the exception of one substation all these also feed nearby streetcar or trolleybus systems, the subway consequently representing about half the total loads. Only one of the two running rails is used for the return of traction current, the other being reserved for signalling circuits. Normally the substations are remotely controlled from a central point through supervisory equipment; in emergency, alarm boxes at 500-800 ft spacing can be used to cut off power from any section of the track, and these boxes are telephonically connected to the control room.

Each bogie carries two collector shoes, one on each side, and shoes on the same car are solidly connected without separate shoe fuses. No positive bus line is carried through the train as each car has a full set of motors. The return circuits are fully insulated from earth and connected to a negative bus line individual to each car. Each axle carries a bronze slip-ring housed in an extension of the gear-box, and bronze graphite brushes in insulated holders lead the current from the negative bus line to the axle slip-rings and thence to the running rails.

Auxiliary Equipment

The low-voltage auxiliary supply is provided by a motor-generator at a nominal 50 V, a lead-acid battery being used floating across the terminals of the generator. The motor driving the set is a simple series machine, overspeed on light load being restrained by the incorporation of two fans on the shaft. The set is rated at 4 kW.

Some 30 kW of heating is provided in each car, power being taken for the resistor banks from the 660 V line. With this loading a temperature of 60° F can be maintained internally with an ambient of 10° F. Recirculation of warm air in winter is provided by a pair of fans in each car driven by a 50 V motor.

Lighting too is taken from the 600 V system, and ordinary filament lamps are used. The arrangement comprises two rows of fixtures totalling 47 lamps. Six of these are battery fed, the remainder being in two groups—one of 20, with a resistor, and one of 21—across the 600 V system. Each lamp is rated at 48 W 30 V. Sockets for the 600 V lamps have short circuiting contacts to restore continuity in the event of a lamp removal or lamp failure. Adjacent lamps are fed from different circuits to minimise passenger discomfort in the event of a failure.

The paper, after dealing with the automatic couplers used to connect together the pairs of cars, and the braking and door control systems, concludes with a comparison of similar systems operating in America and Great Britain. This comparison in its data gives details of the number of cars per set—taken as eight generally, the number of seats, tare, installed horsepower, weight/power ratio, acceleration and average run. The systems concerned include New York (R.10), New York (R.12), Boston (East Extension), L.T.E. aluminium surface stock, L.T.E. steel surface stock, L.T.E. tube stock and the Waterloo and City Line. In America acceleration rates seem to be stabilising at 2·3 m.p.h./sec for vehicles operating on enclosed tracks and

stopping 1½—2 times per mile. The figure for the British tube railways is somewhat lower. In Great Britain, also, the lighting is low voltage, no pressure ventilation is provided and only a small amount of heating is used. These differences are mainly due to climate conditions.

DISCUSSION

MR A. W. MAUSER (London Transport) remarked that blowing out of traction motors on a monthly basis was something that London Transport would not care to contemplate, and he wondered if it was necessary. He thought that with high speed motors a year of running was needed before an assessment of maintenance could be made. The hypoid gear was not regarded with enthusiasm by MR H. H. C. BARTON (Merz and McLellan) as it put back a lot of unsprung weight on the axle. Mechanical design features formed the subject of MR SINCLAIR'S remarks (Glos. Railway Carriage and Wagon Co.), while MR F. W. ROBERTS, (E.E.C.) expressed surprise at the coach heating arrangements whereby the heaters were fed from the line, while the fans were fed from the motor-generator set. MR J. G. BRUCE (London Transport) commented on the use of the tramway gauge of 4 ft 10⅞ in. and asked if provision could be made for conversion to standard gauge at a later date. He also thought that fourth rail return might have been cheaper and shown technical advantages.

MR F. C. E. SMITH suggested that a two-motor equipment with conventional nose suspended motors could be built to give almost the same performance as the four-motor equipment with hypoid drive. London Transport achieved an acceleration of 2 m.p.h./sec with two motor equipment, and the extra 0·3 m.p.h./sec in Toronto hardly seemed worth the additional expense. MR C. M. COCK (E.E.C.) also remarked on the weight of the traction motor and its gearing. The latest motors on the Southern Region suburban stock were 17·8 lb/h.p. including the gears, while the Toronto motors were 13·8 lb/h.p. with a rather weighty transmission system.

MR G. A. MEIER of Switzerland was interested in the lighting system adopted. Tests made on cars in Zurich with lighting connected across the 600 V d.c. line had been most successful. A return to the motor problem took place when MR W. E. LEWIS (G.E.C.) contended that if an operator wanted a high speed motor, an axle-hung machine could be designed to meet the requirement using resilient gears to give quiet running. He wondered what were the advantages of a right angled drive.

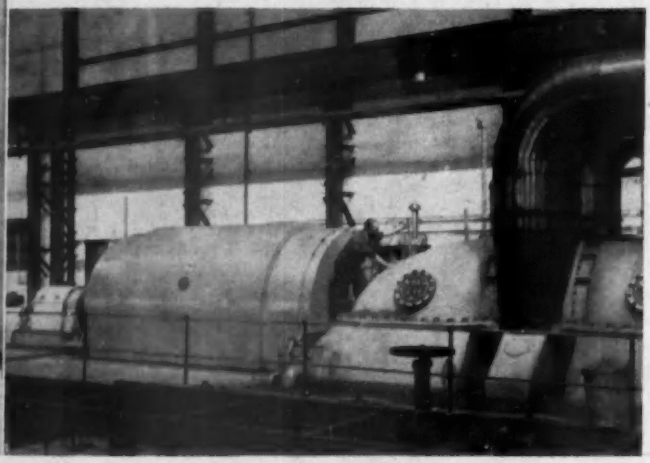
MR CORSON gave a preliminary reply to some of the points raised.

Magnetic Amplifiers for Voltage Regulation

MAGNETIC amplifiers are steadily attaining popularity in connection with the voltage regulation of large generators and synchronous condensers. To meet this demand, the British Thomson-Houston Co. has developed the Magnestat Voltage Regulator, which is generally used in conjunction with an amplidyne exciter which in turn provides the excitation of the main exciter on automatic control. The regulator adjusts the excitation of the amplidyne field to keep the generator voltage within the prescribed limits of ± 1%.

A high speed of response is obtained by adequate forcing of the amplidyne and main exciter field currents and by reducing the time constants of the magnetic amplifier and amplidyne to a minimum. Another important feature is the reversibility of the amplidyne armature voltage making possible the same degree of forcing in both directions, i.e. increasing or decreasing excitation. The amplidyne exciter is driven either by a d.c. motor, supplied from the constant voltage pilot exciter when one is available, or by an a.c. squirrel cage motor supplied from the available l.t., a.c. station supply. This is a flexible arrangement and enables the regulator to be readily applied to both new and existing installations.

Features such as positive phase sequence control, compounding for parallel operation etc., which are common to most voltage regulators, are provided as required. The change over from "hand" to "auto" control and *vice versa* can be made smoothly without disturbance to the system. Protection is provided which automatically returns the generator to "hand" control in the unlikely event of a regulator failure. The various controls such as voltage adjusting rheostat hand/auto control switch, etc., can be mounted either on the regulator cubicle or remote from it as required. The size of the installation is not extensive as can be seen from the photograph.



(Left) Type VM21 Magnestat voltage regulator with amplidyne set on right, with (below) a 30 MW generator with Magnestat voltage regulator. These photographs were taken at the Portsmouth station of the B.E.A. Southern Division

From an engineer's notebook

ONE can hardly pick up a scientific journal nowadays without seeing some reference to radioactive techniques and fresh applications are appearing with something like the frequency of new TV stars. One suggested technique which should appeal to all of us aims at separating shale from coal on a continuous conveyor; it is intended as a preliminary sorting to reduce the volume of material going forward to the flotation process. The principle of separation suggested depends on the back scatter of gamma radiation, using in this case thalium as a radioactive source. It is found that with a 6 in. graphite backing beneath the conveyor, lumps of coal produce no change in the back scatter whereas shale causes it to decrease. Conversely, with aluminium as a backing no change in back scatter occurs with shale since its characteristics are similar to aluminium, but the passage of a lump of coal will cause an increase. Thus a sorting system could be devised with two stages, one with aluminium to select good coal and the other with graphite to reject shale, leaving only the middlings to pass on to flotation. Such a system has the advantage of continuous operation but equally the time for detection and removal of the lumps is short. In consequence this demands a high level of radioactivity. It is hoped by improvement in scintillation detection equipment to reduce the source needed to about one Curie but this may still present some difficulties.

* * *

ONE of the common uses of radioactive tracers is the determination of penetration. In the biological field, however, some trouble has been experienced in their use in measuring the flux through a porous membrane and it has been found under certain limiting factors, results may be obtained that are far too low. A recent application from the world of physics, the measurement of permeability of varnish films, offered no such difficulty since the penetration was from one side only. The technique used, however, is interesting not so much because of the use of tracers but for the mechanical technique associated with it. The varnished test plates were exposed to tritiated water vapour for various times and it was found that full penetration had taken place in one hour for films 1·5 mils thick. The next task was to remove the varnish film in layers, one ten-thousandth of an inch at a time, measuring the radioactivity at each layer for assessment of the moisture concentration. Surprisingly the removal of the film in such thin layers was effected by rubbing with silk. A special device was used with a screw controlled wedge to give micrometric control of the depth of removal, but apart from this, movement by hand of the test plate over silk mounted on a metallographic polishing wheel was all that appeared to be necessary to ensure such close dimensional control.

* * *

I THINK I have mentioned before in these notes that as an apprentice I was taught to identify metals by the sparks they made when ground on a wheel. I feel very humble now before the multiplicity of alloys that are in every day use, and can well understand the need for more refined methods of identification. Again the ingenuity of our instrument designers have been at work until there seems hardly a single physical property of metals that has not been used as a basis of classification. What appears to be a new one to be added to the list is the thermo-electric e.m.f., for an instrument of this type has been put forward which it is claimed can distinguish between two steels differing in carbon content by as little as 0·05%. The device is simplicity itself. Two probes are provided which are maintained constant at different temperature values. By applying the probes to the unknown metal a thermo e.m.f. is obtained, the value of which will depend on the characteristic of the unknown metal. It is only necessary to measure the e.m.f. produced and from previous calibrations the metal can be identified.

* * *

MINIATURISATION is a big word for a small subject. This cult of ever smaller instruments comes from the modern practice of fitting two instruments where often one has been used before. Perhaps someday someone will rediscover the value of having one or two instruments that can be easily read instead of a confusion of miniatures. I am certain to be taken to task for these sentiments and I must concede a need for miniature instruments in certain cases but I believe there are not a few cases where it is carried to excess. Whatever our views on miniaturisation may be, we all join in paying a tribute to the ingenuity of instrument designers in meeting ever decreasing dimensional specifications. A recent design using an unusual approach achieves an instrument as small as one inch in diameter and, with a pointer deflection of 260°, a scale length of 2·2 in. is obtained. This compactness is achieved by making one limb of the rectangular coil the centre around which the coil rotates, encircling a soft iron ring. At one point, over which the coil does not operate, is a projection on the iron ring and across this is a magnetic flux, from the two ends of a permanent magnet arranged in the form of an arc around the instrument. As one would expect from the uneven flux distribution in such a design there is considerable cramping of the scales at the two ends. It is stated that by suitable design of the iron circuit this can be evened out but it would seem to me that there is a severe limit to the shaping that can be done with this design.

* * *

TO conclude with a "cocktail" is contrary to social etiquette. But such is the name given to a water and alcohol mixture suggested for boosting jet engines in order to provide an extra boost for take-off of Stratojets. The alcohol, ignited by jet gases, vaporises the water sprayed into the combustion chamber, and the vapour thus produced increases the mass flow through the engine providing the greater thrust. Perhaps once more we shall have that story refurbished from early motoring days of how the last lap of a race was won on a bottle of whiskey.—

E. R. G.

ELECTRIC POWER IN NATION'S RESEARCH

EXPENDITURE on the work of the Department of Scientific and Industrial Research during the current financial year has been estimated at over £6m. To what end this money is being spent is reviewed at length in the Department's Report for the year ended 30th September, 1954. An impressive range of research and development work is covered, in which electrical engineering topics play a prominent part.

The work of D.S.I.R. splits into two main sections. Fourteen Research Directorates of the Department, such as the Fuel Research Laboratory and the National Physical Laboratory carry out broad investigations. Associated with them are the industrial research associations which receive substantial grants. Both sectors receive consideration in the Report: but here attention is confined to the research stations.

Amongst projects at the Building Research Station is the development of a heat meter. Non-availability of a suitable meter presents difficulties when large scale domestic heating is being considered, as with district heating schemes. Tests have been made with an evaporative form of meter, which is clamped to the radiator. Heat emission from the radiator is registered by evaporation of liquid in a graduated tube. This meter is thought to be technically promising. Nor is this the only concern of the Station with domestic heating. Investigations into expenditure of households are being continued, and in the Scottish laboratory the efficiency of electric floor and wall panel heating in schools is being assessed.

A power station topic appears somewhat unexpectedly in the notes on the Forest Products Research Laboratory. So-called "soft rot" is the subject, a trouble found in cooling towers and associated with fungi known as Ascomycete. What the fungi feed on, and how they decompose the wood is being investigated, and there is close co-operation with the B.E.A.

The Fuel Research Station usually has something of electricity supply interest, and this year's report is no exception. Bonded deposits in boilers fired with pulverised coal and high chlorine content is one current study. This is directing attention to reducing difficulties by attention to the placing of superheating tubes. Moreover, calcium salts appear to act as the bonding agent, rather than the potassium and sodium salts familiar as causing trouble with stoker-fired boilers; and the ratio of sulphur to chlorine in the coal is significant. In this work, it is interesting to note, radio-active tracer techniques are used.

At the other end of the heating scale, the Station's work on domestic heating is continuing unabated. Attention is now being directed to the practicability of establishing "room heating efficiencies" for the main types of heating equipment; such criteria should give a better comparison of effectiveness than the bench test efficiencies that have been used before.

Heat transfer is one of the many subjects on which the Mechanical Engineering Research Laboratory is concerned. A new laboratory is now being built, and pending its completion, work is proceeding on an extra-mural basis. Steam condensers are a case in point. At Queen Mary College, London, the possibility of making the steam condense as drops rather than as film is under investigation. A successful outcome of this work might, it is estimated, save 20% to 40% of the metal at present used in the construction of condensers. Substances have been found which will promote such "dropwise" condensation, and preparations for full scale tests in an actual power-station condenser are in hand.

Higher Steam Temperatures

Yet another aspect of the thermodynamics of steam power stations is brought out in the notes on the National Physical Laboratory which has been carrying out for the E.R.A. tests on the behaviour of metals at high temperatures. The report is optimistic. "It has become clear that it is practicable for steam temperatures to be appreciably higher than are contemplated at present; important improvements of the thermal efficiencies of generating stations thus appear to be possible, but much development work is necessary before these improvements can be realised." Particular interest has been excited by steels containing 6 to 8% of chromium, which are thought to be capable of bearing useful loads at temperatures of well above 1000° F. By doing so they may permit replacement of expensive austenitic steels in certain components of generating equipment.

In so short a space only a few isolated topics of interest can possibly be covered. More detailed information of the good return for the £6m. a year investment of D.S.I.R. will be given when the detailed reports of research stations and associations come to be published later this year.

Sign Manufacturers' Luncheon

THAT the brilliance of modern electric signs, particularly in Trafalgar Square, is partially clouded by official disapproval in some quarters was much in evidence at last week's luncheon of the Electric Sign Manufacturers Association, but the tone of speakers clearly indicated that E.S.M.A. is forthrightly setting about removing any grounds such disapproval may have had. Particularly useful in this respect is their encouragement of good design, evinced by the presentation of prizes to their first Sign Design Competition, an event which is to be continued and should do much to improve the appearance of electric signs.

In opening the speeches by proposing "The Ministry of Housing and Local Government," Mr J. H. G. Pearce, E.S.M.A. Chairman, referred to the Association's dislike of the outcome of the present system which, requiring plans of lighting schemes to be submitted to Local Authorities for approval, resulted in wide variations of standards. He not only emphasised the Association's consciousness of the need for good design of signs, but stressed that illumination identification of buildings was now as important in architecture as other services. Responding, Mr W. Deedes, M.P., Parliamentary Secretary to the Ministry, confessed to a weakness for bright lights, but felt that, as a whole, the country still suffered the inhibitions engendered by the blackout and power shortage eras. As a strong believer in the sovereignty of Local Authorities, he felt that consistency of appearance would never be attained.

In an admirably brief but all embracing speech, Mr F. F. Newlands, Vice-Chairman of the Association, proposed "The Guests," to which, Misha Black, O.B.E., replied. He felt that the illuminated sign had become an integral part of the urban scene, and that although there were cases of bad design, the whole picture showed that the good signs outshone the bad.

Electrical Progress in 1954

TECHNICAL INTEREST IN THE OUTPUT OF A LEADING ELECTRICAL MANUFACTURER

FOR Ferguson Pailin, 1954 has been a year of increased activity in both the development and manufacturing fields. Output of switchgear has continued at all voltages ranging from 275 kV down to 415 V. In the high-voltage field, the past year has seen the completion of the first substation on the 275 kV Supergrid, for which the company manufactured the isolating switches; and the equipment for two other Supergrid substations, at Uskmouth and Penwortham, at which the company is main contractor, is in course of manufacture.

New substations on the 132 kV grid have been completed, including a seven-switch duplicate-busbar installation at Kirkby, for the N.W., M. and N. Wales division of the B.E.A. In addition extensions have been completed to numerous existing 132 kV substations, notably at Roosecote, Connah's Quay and Carmarthen Bay, the latter being equipped with indoor air blast circuit-breakers. A new 132 kV five switch outdoor substation is under construction at Shin, forming part of the general development being carried out by the North of Scotland Hydro-Electric Board.

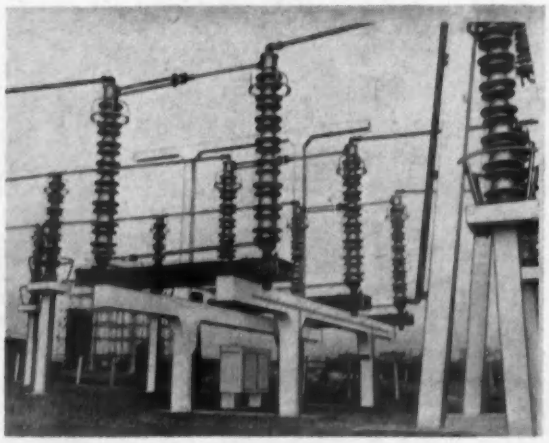


Fig. 1 (above) 275 kV isolator at West Melton. Fig. 2 (at top of page) Ocker Hill—33 kV and lower voltage distribution system

A major reconstruction and extension programme of the 33 kV distribution switchgear at Ocker Hill was completed for the Midlands Electricity Board. This scheme also included the reconstruction of the lower voltage switchgear at the substation. For the London Electricity Board, a large new substation housing 19 metalclad units, was completed at Shorts Gardens, for the reinforcement of the 22 kV distribution system. Work is also in progress on the equipment for a new Grid intake point to be established in the Sheffield district, by the Yorkshire Electricity Board. This installation will comprise a 22-panel, 33 kV, 750 MVA indoor metalclad switchboard of modern design and performance standards.

In the medium voltage range a notable example of work for industrial consumers is the distribution switchgear for the control of auxiliary supplies to the Velindra works of The Steel Company of Wales, comprising one 11 kV, 250 MVA duplicate busbar and three single busbar metalclad switchboards. The comparatively recent introduction of the 11 kV ring-main fuse-switchgear, has proved most successful and examples can be seen at the Electrical Engineers' Exhibition at Earls Court.

Steady progress has been maintained in the overseas market, against increasing world-wide competition, and a high level of output has been achieved.

Various contracts for indoor and outdoor switchgear up to 33 kV were obtained or were in progress during the year; one worth noting being an order for 20·5 kV, 750 MVA metalclad switchgear for two key substations in Johannesburg. In the same territory a further order was received for 24 indoor frame mounted 40 kV, 1,000 MVA breakers for service on the Rand system.

A substantial order for urgent delivery of 14-132 kV, 3,500 MVA bulk oil outdoor circuit-breakers was obtained from the Electricity Commission of New South Wales for Lake Macquarie power station. An example of the extensive competition now being experienced is an order obtained against 63 competitors for 50 type BV Ring Main 11 kV, 250 MVA metalclad equipments for Cairo.

The volume of 11 kV and LV switchgear business from the colonial market has been maintained and substantial orders for these and higher ratings have been received.

Refrigerators and the Country's Economy

IMPORTANCE OF A RAPIDLY-EXPANDING INDUSTRY

LAST Friday, the British Refrigeration Association held a dinner at the Savoy Hotel, London, where well over 250 members and guests were present. The first toast on this occasion was proposed by Thomas Whittaker, Esq., and was to the Rt. Hon. Selwyn Lloyd, Minister of Supply, who was the principal guest.

The sponsoring government department for the refrigeration industry, said Mr Whittaker, was the Ministry of Supply. The industry had proceeded since the war in a series of kangaroo-like bounds and now had an output valued at some £28m per annum. Further extensions of output were envisaged. It was essentially an industry in which technique and engineering skill remained of prime importance, and at the moment was making a substantial contribution to the export market.

Problems to be Solved

There were, however, one or two problems he would like to put forward to the Minister. At the moment, the industry was suffering from a severe shortage of steel strip and sheet. Sub-contractors in key positions were finding the position fraught with difficulty and delay. The iron and steel programme envisaged an annual increase of output of about 5%, but the refrigeration industry was expanding much faster than that. It was possible that the present dependence on imported steels at much higher prices than those fixed for home produced steel would last much longer than it should, with consequent repercussions on a competitive export market.

A second point was the presence of three large countries which could provide good markets but which were not being utilised. These were Argentine, Brazil and Turkey. Could the Minister give an assurance that the interests of British manufacturers were being considered with respect to trade in these countries?

Third, there was the question of convertible currency. If sterling were to become fully convertible, America would gain free access to British markets, particularly at home. American mass-production methods and selling could often throw up large numbers of units at the end of a run, and, particularly in the domestic field, these would be available for "dumping" abroad. The Americans themselves already had "anti-dumping" legislation and it was to be hoped that the British government would. if free convertible currency became available, arm itself similarly.

Finally, Mr Whittaker emphasised again that the domestic refrigerator had become a necessity. With hire purchase it was possible for every home to have one. It was, however, apparently impossible to correct the old view of refrigerators as luxury items, held by Whitehall. Whenever a financial crisis occurred the refrigerator found itself in the front line. It was time that such an essential unit had a more reasonable rate of purchase tax, well under 50%. Nevertheless, the industry looked to the future with confidence and optimism.

The Government's View

Replying, the Rt. Hon. Selwyn Lloyd gave some initial statistics of the industry, which in 1954 had an output valued at some £30m, exported to 130 individual overseas markets, employed over 15,000 workers and had some 200 firms. In the United Kingdom only one in ten of the households had a refrigerator; in the United States four out of five homes wired for electricity had an installation. There was, however, a reasonable margin of capacity available in the British refrigeration industry which could be used for future expansion. Refrigeration was becoming of wide application. It was used in medicine, science and defence. There were over forty types of air-conditioned vehicles used by the armed forces.

Coming to Mr Whittaker's question on sheet metal, the Minister said that by 1958 the increase in production should be about 600,000 tons. It was, however, unlikely that the industry could meet the home demand in full for some time. As an alleviation of the cost of imported steel, the government had, however, removed import duties.

As far as purchase tax was concerned, he could not anticipate the Budget, and on the question of competition arising due to possible convertibility it was unwise to be defeatist—the government would watch the situation very closely indeed. The desire for a flourishing trade with Argentine, Brazil and Turkey was shared by the government, but they were countries at present short of money.

Hire purchase, he thought, was proper and essential as far as refrigerators were concerned. The present restriction of 15% down and the balance in two years was reasonable with regard to the general financial situation.

The toast of "the Guests" was proposed by Mr D. S. Carruthers, the response being by Mr A. F. Plummer (President of the E.C.A.) and "the British Refrigeration Associated" was proposed by Mr H. A. Binney (Director of the British Standards Association), the response being made by Mr R. H. Hemmings, Chairman of the Association, who referred to the part played by the Association in promoting industrial welfare. He thought the arrangements for technological development and industrial welfare were much better in this country than abroad.

North-Western I.E.E. Centre Dinner

SOME 400 members and guests were present last Tuesday (8th March) at the Annual Dinner of the N.W. Centre where the principal guest was the Lord Mayor of Manchester, who proposed the toast of "the Institution."

The response was made by Prof Willis Jackson, Vice-President of the I.E.E., who conveyed an apology for absence, and a message of good wishes, from the President.

Mentioning the retirement of Messrs E. L. Green and L Carr, to both of whom he conveyed the Centre's best wishes for a long and happy retirement, the speaker said that these gentlemen represented to the N.W. Centre what the Centre represented to the Institution as a whole. In the concentration and variety of industrial activity with supporting education for industry, the North West was second to none. It was no longer possible to regard schools as distinct from the work of development. They were now a component part of a single process and greater collaboration was necessary. Here the I.E.E. and sister institutions could act as a bridge and platform between the component parts. The Vice-President continued "Knowledge is less important and valuable than inquisitiveness." He went on to mention the Joint Conference on nuclear power, and the joint journal which will include all papers dealing with this subject.

INDUSTRIAL MAINTENANCE

Selecting and Installing MICRO SWITCHES

ALTHOUGH the micro switch has been used extensively for many years in every branch of industry to facilitate or initiate some type of automatic control in production machine and product, there are still designers and engineers who do not fully appreciate that the selection of the most suitable model and its correct installation are matters demanding care and understanding. The following notes are addressed to all who are interested in obtaining the highest possible degree of efficiency.

The manufacturers market scores of standard micro switches, which are available from stock or at short delivery, and many more have been designed and made specially to satisfy unusual circumstances. Each of these models has its own set of operating characteristics, its own mode of actuation and its own physical peculiarities, which together give it an individual quality ideally suited to a certain set of site conditions. Any one of perhaps three or four switches would meet most of the requirements, but only one of these will meet all the requirements ideally. It is necessary to find that one model if a really efficient installation is to be the result.

Selection normally calls for the assistance of the manufacturer's engineer. He will consider each aspect of the application in turn, at each stage eliminating models which are unsuitable, until he is able to pick out the correct type of switch for the job. The following are the main features which will effect selection:

1. Space availability.

2. Electrical Ratings. The suitability of any micro switch for a.c. loads may be checked simply by referring to manufacturers' catalogues. If it is desired to interrupt d.c. loads, the fullest possible information about the application, in particular the current, voltage, resistive and inductive values of the circuit, which pair of contacts, (normally-open or normally-closed) it is proposed to use and the anticipated frequency of operation, should be submitted to the manufacturers for consideration

3. Method of Actuation. Many types of pin plungers, spring plungers, leaf springs, levers and roller-levers are available as standard, while other actuating devices of special sizes and shapes can be provided when the necessity arises. It should be borne in mind that side thrust on plunger actuators must be avoided and unless the operating force can be transmitted in a straight line to the top of the plunger, this type should not be used. Lever actuators are ideal for situations where the operating force cannot be confined to straight line travel, and roller-levers are the most suitable devices for fast moving media such as cams and slides.

4. Force and Movement Characteristics. The force required to operate the micro switch must obviously be related to the available force of the actuating medium. Equally important, although perhaps not quite so obvious, is the need to consider movement differential and total travel. Full details for every switch can be obtained, in the case of Burgess micro switches, by reference to the appropriate drawing or data sheet.

5. Repeat Accuracy. If this is required in high degree, switches provided with leaf spring actuators should be avoided, as these may take on a slight set after much use. Plunger and lever actuated models have good repeat accuracy, but obviously some are better than others and the manufacturers' advice should be taken on this matter.

6. Hazards. Will the micro switch be subjected to extremes of temperature, excessive vibration, physical violence, oil, suds or chemical (such as hydraulic fluid splashing)? It is as well to investigate these possibilities and request the manufacturers to recommend switches which will withstand best the particular hazard anticipated.

7. Method of mounting.

8. Are the switch leads to be run in conduit or not?

Installation

When the most suitable micro switch for the job has been found, the next consideration is its correct installation. Errors here can appreciably reduce the life and efficiency of the switch, so the following points should be carefully watched.

Give the micro switch the maximum protection against physical violence and abuse.

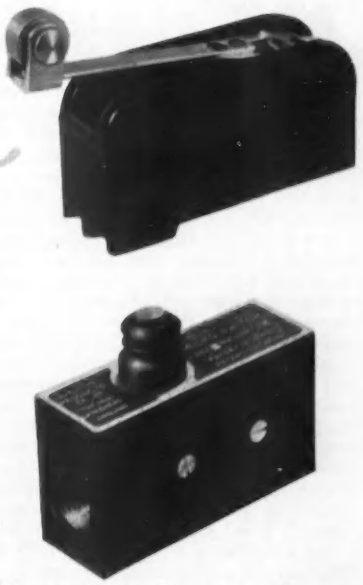
Ensure that the maximum recommended overtravel movement of the switch actuator, as stated on the relevent data sheet or drawing, cannot be exceeded in any circumstances. Should it be impossible to positively limit the travel of the actuating medium, it is good policy to provide a mechanical stop which will prevent it going too far. To use the switch itself as a stop for the actuating medium is bad practice which will seriously affect its life. The optimum travel of the actuating medium is that which depresses the actuating plunger or lever of the micro switch to a point approximately midway between the tripping point and the point where it "bottoms."

Is it possible for unskilled hands to tamper with the adjustment of the actuating medium, thereby upsetting the optimum conditions?

Is the actuating medium made of sufficiently tough material to withstand wear? This point, and the previous one, draw attention to common causes of disappointment to users of micro switches who require repeat accuracy to within fine limits.

If a non-sealed type of micro switch is being used in a situation where the risk of oil or other splashing cannot be ruled out, or when the atmosphere is dust-laden, it is better to mount the switch in an upside-down position in order to give maximum protection to the actuating device. (Sealed types, such as the Burgess Products' CRLN, should always be mounted with the plunger uppermost).

When running cables to a micro switch not equipped with conduit terminating facilities, support the cable near to the switch terminals.



The two examples of micro switches seen here show different actuating mechanisms

Panel-mounting switches which are secured by means of lock nuts on their actuating plunger bosses should be wired up while held in the hand and mounted with leads already attached. In this way possible strain on the plunger assembly will be avoided.

Do not attempt to enlarge the fixing holes of micro switches. Dangerously reduced insulation between an internal contact and the fixing screw may well be the result.

Don't use a long handled screwdriver to mount your micro switch!

Before switching on the equipment for its trial run, it is advisable to have a last look at the micro switch to make quite sure that mounting position, method of actuation and electrical connections are as perfect as human ingenuity can make them. Manually operate the actuating medium until it is bearing on to the switch actuator to the fullest extent; in that position there should be still a little travel left in the plunger or lever before it becomes solid. Look around for possible future snags and make sure that in every respect the application is a good one and the micro switch will be getting considerate treatment.

Many micro switches (those of Burgess Products Co., Ltd., for example) normally require no maintenance whatsoever while in service and give of their best if left severely alone. Of course, it is continually necessary to guard against abuse and in this connection it is perhaps worth while to mention three common causes of premature disaster.

The first of these is lubricating the actuating devices of micro switches. Burgess models are provided with oil retaining bushes or seals at the few points where lubrication is desirable so there is never any need to oil, and the practice should be avoided at all costs because of the danger of it entering the switch.

The second is the practice in some industries of cleaning down machines with high pressure hoses. Unsealed micro switches will not survive for long in a forceful jet of water and they should be adequately protected against it.

The third danger is paint, a natural enemy of any finely-adjusted mechanism. If it is necessary to paint the machine or equipment, either do so before the micro switches are fitted or, if that is not possible, give strict instructions to the painter to keep well away from the switches.

It is well worth while remembering that 99% of all premature failures of micro switches are due to mechanical troubles directly attributable to maladjusted actuating media, whether caused by faulty setting up in the first place or by loss of accuracy due to wear or ignorant tinkering in later life.

One final thought: micro switches are expendable articles and will not last for ever, even when given the best of treatment. This is common sense, of course, yet is it surprising how often it is forgotten. So often a switch is installed in some out-of-the-way situation and there it operates day in and day out for years, quite forgotten until at last the inevitable happens and it fails to function. If such an occurrence on your equipment would cause danger or expensive delay, it is as well to obtain an estimate of life for your switches and to replace them when this time is up. The manufacturers will be pleased to make this estimate after their engineer has studied your applications.

We are indebted to Burgess Products Co. Ltd., for the information on which this article is based. Although of general application, its recommendations apply with special effect to this firm's models.

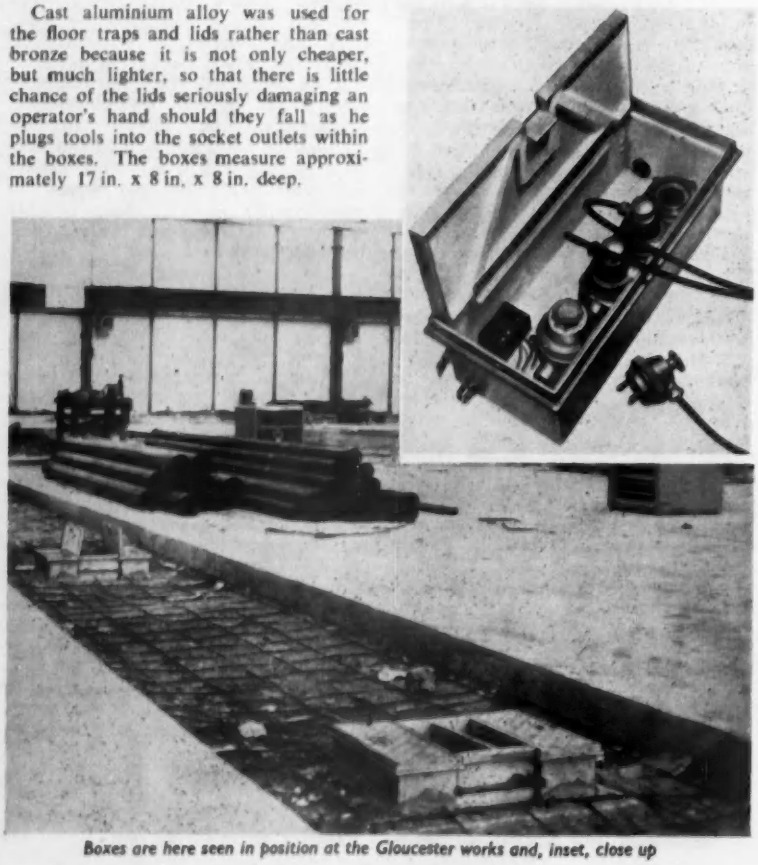
Floor Boxes Feed Portable Tools

AIRCRAFT assembly and servicing of necessity involves using buildings with a wide span, and in these circumstances the arrangement of electricity supply for portable and transportable tools becomes a difficult problem. In a new flow-line assembly for Javelin and other aircraft, set up at the works of the Gloster Aircraft Co., Ltd., hundreds of floor boxes of a new type are used to solve this difficulty.

With the span of an aircraft, to feed tools from overhead power lines would have involved trailing cables in the way of progressing assemblies. On the other hand, cables running along the ground would be liable to damage from the 20 to 30 ton structures. Furthermore, the works at Gloucester are little above sea level and the effects of dampness, flooding, and sweating have to be considered.

For these reasons, corrosion-proof cast aluminium alloy was used for the boxes, traps and lids, which are capable of sustaining a weight of 30 tons, by The General Electric Company Ltd., which designed and manufactured the boxes. The boxes themselves are of mild steel of heavy gauge, hot-spelter-galvanised overall, with interiors coated with two coats of Corktex paint, a special compound used by the Admiralty as an antidote to sweating and condensation. Electricity supply to the boxes is through armoured cable and within the boxes through p.v.c. insulated cable, a 7/·036 cable entry being provided at each end. The electrical equipment in each box, each item of which is watertight, comprises three 6 A watertight socket outlets with a controlling switch.

Cast aluminium alloy was used for the floor traps and lids rather than cast bronze because it is not only cheaper, but much lighter, so that there is little chance of the lids seriously damaging an operator's hand should they fall as he plugs tools into the socket outlets within the boxes. The boxes measure approximately 17 in. x 8 in. x 8 in. deep.



Boxes are here seen in position at the Gloucester works and, inset, close up

System Eases Volt Drop Calculations

by V. E. CONNOR, B.Sc., A.M.I.E.E. *

CALCULATIONS involved in planning works installations can be made much easier if they are approached in a systematic manner. In dealing with a lighting installation the two-fold problem exists of estimating the maximum volts drop, and also deciding the size of conduit required to carry an assortment of v.r.i. cables. These tasks have been facilitated by extracting information from the tables given in the I.E.E. Regulations, and calculating certain factors from this. These factors are then applied to check the sizes of cable and conduit tentatively chosen.

Table 1 is based on Tables 5 and 8 of the I.E.E. Regulations taking the values for four conductors bunched in one conduit. It includes a column headed "millivolt drop factor," which gives a factor calculated from the I.E.E. Regulations for each size of cable. This when multiplied by the current (amps) and the length of cable (feet) will give the millivolt drop per conductor. Addition of the millivolt drop for "go" and "return" and division by 1,000 then gives the voltage drop at the remote end of the run.

Application of the table is best understood by reference to Fig. 1. This gives a rough physical layout of a section of a lighting installation with the lengths of run indicated. The lamps shown are controlled in four groups, fed by R_1, R_2, R_3 and R_4 with a common neutral throughout. The supply is at 240 V, and so the maximum allowable voltage drop is 5·8 V. The currents indicated in the figure are calculated at 0·5 A for each lamp, no allowance being made for diversity. On this basis, the calculations are made with a maximum drop of about 4 V in mind, to allow for inaccuracies and for future extensions.

Tables 2 and 3 show how the calculation is set out for one feeder. For each section in the wiring between changes of conditions, a volt drop value is calculated by multiplying the millivolt drop factor from Table 1 by the current and the length of run. A running total is kept as shown in the last column. Table 3, relates to the neutral in a similar manner.

The millivolt drop values are extracted from these tables and added together to give the total voltage drop at each lighting point. For instance, for point K, the total millivolt drop is 1,034 + 1,167, giving 2,201 mV or 2·2 V. For point R, the value is 1,301+1,782=3,083 mV or 3·1 V. If the cable sizes selected give an excessive voltage drop at any point, a glance at the mV drop schedule shows at once where reinforcement is required.

Deciding the size of conduit is based on Table 22 of the I.E.E. Regulations. "Maximum Capacity of Conduits." Examination of this shows that the maximum percentage of the internal cross-section of the conduit permitted to be occupied by cable is about 40%. Table 4 gives the value worked out on this basis for various sizes of heavy gauge steel conduit to B.S. 31 Class B. The addition of the various cable cross-sectional areas required as given in Table 1 gives the diameter of conduit required.

TABLE 4. CONDUIT SIZES AND AVAILABLE AREAS.

⅜	½	1	1¼	1½	2
·078	·115	·230	·385	·564	1·04

The top line shows conduit overall diameter, inches and the bottom, the area available for cables, in square inches.

TABLE 1. MILLIVOLT DROP FACTORS FOR V.R.I, T AND B CABLES.

Conductor		Max. Amps.	mV Drop Factor	Overall cross sectional area	Conductor		Max. Amps.	mV Drop Factor	Overall cross-sectional area
sq in.	No/Dia.				sq in.	No/Dia.			
0·0015	1/·044	5	5·55	0·0177	0·0145	7/·052	36	0·63	0·0660
0·002	3/·029	10	4·17	0·0214	0·0225	7/·064	45	0·41	0·0830
0·003	3/·036	15	3·02	0·0255	0·03	19/·044	52	0·32	0·1046
0·0045	7/·029	20	1·92	0·0284	0·04	19/·052	62	0·23	0·1353
0·007	7/·036	23	1·28	0·0380	0·06	19/·064	82	0·15	0·1847
0·01	7/·044	30	0·88	0·0510					

TABLE 2. CALCULATIONS FOR PHASE FEED R_1.

Run	Cable Size	Length of Run Feet	Current Amps	mV drop	mV drop. Running Total
A–B	3/·029	50	4	4·17 × 50 × 4 = 834	834
B–C	3/·029	32	2	4·17 × 32 × 2 = 267	1101
B–K	3/·029	24	2	4·17 × 24 × 2 = 200	**1034**
C–R	3/·029	24	2	4·17 × 24 × 2 = 200	**1031**

TABLE 3. NEUTRAL VOLT DROP CALCULATIONS FOR POINTS K AND R.

Run	Cable Size	Length of Run Feet	Current Amps	mV drop	mV drop Running Total
A–B	7/·036	50	14	1·28 × 50 × 14 = 896	896
B–C	7/·029	32	10	1·92 × 32 × 10 = 615	1511
B–G	3/·029	5	4	4·17 × 5 × 4 = 83	979
G–H	3/·029	7	3	4·17 × 7 × 3 = 88	1067
H–K	3/·029	12	2	4·17 × 12 × 2 = 100	**1167**
C–M	3/·029	5	4	4·17 × 5 × 4 = 83	1594
M–N	3/·029	7	3	4·17 × 7 × 3 = 88	1682
N–R	3/·029	12	2	4·17 × 12 × 2 = 100	**1782**

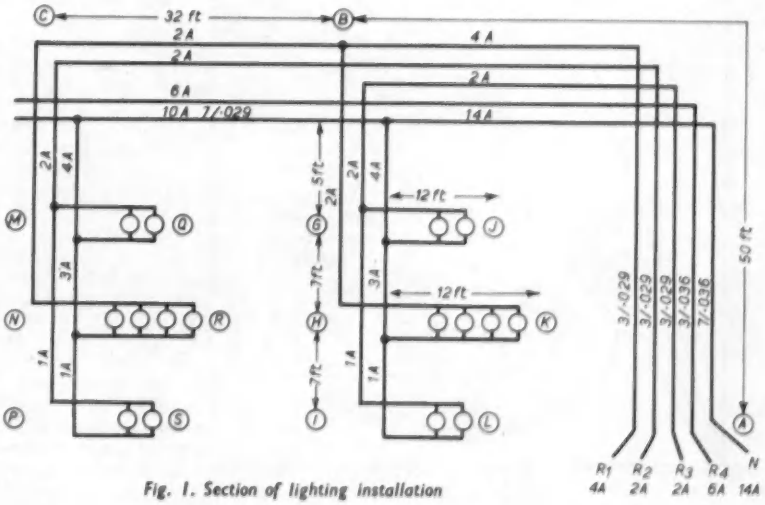


Fig. 1. Section of lighting installation

* Mr Connor is with Astral Switchgear.

DYNAMO TROUBLES

—and some notes on their Treatment

by J. L. WATTS, A.M.I.E.E., A.M.C.T.

A WIDE variety of faults may be experienced with d.c. dynamos, many of them associated with field windings and with brush positioning. The present article discusses such faults and suggests methods for their correction.

Reversal of Rotation

In addition to defects which are common to other types of electrical machines direct-current dynamos may give trouble due to failing to build up their correct voltage. This may be due to driving the machine in the wrong direction, in which case the small value of shunt field current resulting from the residual magnetism will create a magnetic field which opposes and weakens the residual magnetism, thus preventing the machine from building up to more than a very low voltage. In this case the voltage between the brushes may be higher with the shunt field windings open circuited than when they are in circuit. For correct operation the shunt field coils should create magnetism of the same polarity as the residual magnetism, each interpole should have the same polarity as the next pole forward in the direction of rotation whilst, in a cumulative - compound dynamo, each series field coil should have the same polarity as the shunt field coil on the same pole.

A shunt motor should generate when driven in the same direction as it motors, and should then have the same terminal polarity. When converting a cumulative-compound motor into a dynamo for the same direction of rotation, however, the connections to the series field windings should be reversed. A dynamo can be adapted for reversed rotation by reversing the connections to the shunt field windings, in which case the terminal polarity will also be reversed; however, the connections to the series field windings also should be reversed if the machine is compounded. Another method of operating the dynamo with reversed rotation, which gives unchanged terminal polarity, is to reverse the connections to the armature. In the case of an interpole dynamo the connections to the armature and interpole coils as a whole should be reversed, the connection between the armature and interpole windings being undisturbed.

Failure to Excite

Various causes may prevent a dynamo building up to its correct voltage when run up to speed. The initial voltage generated by the armature is quite low, since the residual magnetism is comparatively weak. In order that the dynamo may build up to an increased value the resistance of the shunt field circuit must be less than a certain critical value. The shunt circuit resistance may be increased to such a value that the dynamo cannot build up voltage if the brushes fail to make good contact with the commutator. This may result from the brushes sticking due to foreign matter; inadequate brush pressure, the brushes being worn, the commutator being dirty, rough, out of truth, or the inter-segment micas projecting above the surface of the commutator. Normally the pressure on the brushes should be about 2 pounds per square inch of brush contact area; higher if there is vibration.

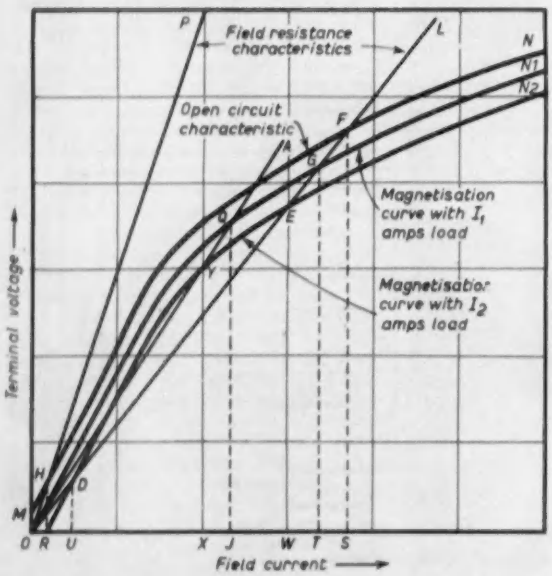


Fig. 1. Magnetisation curves of a shunt dynamo on no-load and on varying loads

Field Circuit Resistance

The curve MN in Fig. 1 may represent the voltage generated by a dynamo on no load with various values of field current, the value OM being that generated due to the residual magnetism alone. If the resistance of the shunt field circuit is high, as represented by the line OP the maximum voltage to which the dynamo will build up on no load will be RH because, in order to generate a higher voltage, a greater shunt field current will be required than will be passed by the voltage RH.

The resistance of the shunt field circuit may exceed the critical value if the voltage regulator is set for minimum voltage, and a higher voltage setting may be required. If the moving contact of the regulator fails to make contact with the studs, or there is an open circuit in the field circuit, the voltage will not build up. In case of trouble it may be worth while trying the effect of short-circuiting the regulator. If a shunt dynamo fails to build up voltage when the load circuit is closed the main switch should be opened, as a low resistance load circuit may prevent building up. When a dynamo is supplying a load circuit there will be some reduction of the generated voltage due to armature reaction, and a volt drop in the armature due to its resistance. These effects will reduce the shunt field current, and thus reduce the voltage to which the dynamo will build up on load. On a load of I_1 A the terminal voltage with various shunt field currents may be represented by the curve ON_1, whilst the curve ON_2 refers to the terminal voltage with a load current of I_2 A, assuming that the load is switched on after the dynamo has been allowed to build up on no load.

If the dynamo is started up whilst connected to a load circuit giving I_1 A at TG V, with a fairly high resistance field circuit as represented by OA, it would only build up to the voltage JQ. If started up with this field resistance, whilst connected to a load circuit giving I_2 A at WE V, the dynamo would not build up, although it would develop the voltage XY if the load circuit was connected after the machine had built up. In order to give I_1 A at TG V, or I_2 A at WE V the shunt field circuit resistance must be reduced, as represented by the line OL. A dynamo may, therefore, refuse to build up if load is switched on, as might occur due to a starter handle sticking "on."

Building up of a Compound Dynamo

It may be that a compound dynamo fails to build up when unloaded, when only the shunt field coils are operative, but does build up when load circuits are switched on. These complete a circuit through which load current can pass via the series field coils to augment the field magnetism. The increased voltage generated will thus increase the shunt field current, and the dynamo may then maintain its voltage after the load has been switched off. A similar load circuit may be provided by connecting across the terminals of the compound dynamo a

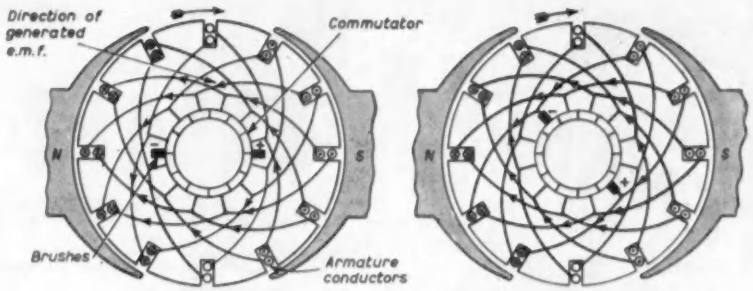


Fig. 2. Effect of brush movement. (a-left) brushes in neutral position; (b-right) brushes advanced from neutral

piece of fuse wire, which melts as the dynamo builds up voltage. When two or more compound dynamos are used in parallel an incoming dynamo may be magnetised by closing the equalising switches to connect its series field windings in parallel with those of a loaded dynamo.

Wrong Brush Positions

The armature windings of a dynamo form two or more parallel circuits, depending on the design of the armature and the number of field poles. When the dynamo brushes are set in the neutral position the e.m.f. generated in all the armature coils in each parallel circuit will act in the same direction, so that maximum e.m.f. will be generated between the brushes, as shown in Fig. 2 (*a*). If, however, the brushes are away from the neutral position, as shown in Fig. 2 (*b*), in each of the parallel circuits the e.m.f. generated in some of the coils will oppose that generated in the other coils; thus reducing the voltage between the brushes. Thus incorrect brush position may reduce the shunt field current and prevent the dynamo building up.

Loss or Reversal of Residual Magnetism

A dynamo may fail to build up voltage due to loss of its residual magnetism, which may result from a severe mechanical shock, a strong magnetic field nearby, or reversal of current through all or part of the field windings. Such field current reversal may occur during tests or repair, or if the dynamo has been used as a motor. Reversal of current through the series field coils of a compound dynamo may occur due to connecting the dynamo in parallel with one which is generating a higher voltage, if the equalising switches are not first closed to connect the series field windings of the two machines in parallel.

Loss of, or reversal of, residual magnetism may result from allowing a dynamo to slow down whilst connected to a running motor which drives a load of comparatively high inertia. In this event the motor will act as a dynamo whilst slowing down and may generate a greater voltage than the dynamo. If connected to the dynamo the motor may then pass a reverse current through the armature, series field coils, and interpole

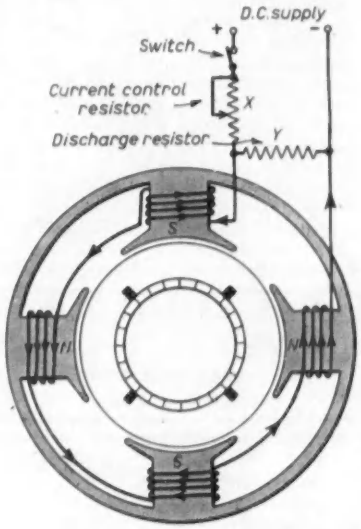


Fig. 3. Connections of safety resistors when remagnetising field system

coils of the dynamo, whilst at the same time the shunt field windings of the dynamo will have little effect in maintaining the correct magnetic polarity. Increase of speed may assist a dynamo to build up if the residual magnetism is weak.

Remagnetising Field Magnets

If facilities are available for so doing the field magnets of a shunt dynamo can be remagnetised with correct polarity by running the dynamo as a motor with the same terminal polarity and rotation as when used as a dynamo. Another method is to disconnect the shunt field windings from the armature and supply these windings from a separate d.c. source, such as a battery, before reconnecting the windings to the armature and restarting the dynamo.

The shunt field windings of a dynamo, however, should not be interrupted whilst carrying more than about one-third of the rated field current, otherwise, a high voltage may be induced in the field windings which may break down the insulation. The induced voltage is proportional to the rate of change of the magnetic flux and to the number of turns in the field coils. Interruption of a high value of shunt field current could be avoided by connecting the field windings to another dynamo of the same, or a lower, voltage; allowing the latter dynamo to slow down, or reducing its voltage by means of the field regulator, before disconnecting the field windings of the defective machine. If a dynamo is to be remagnetised by connecting its shunt windings to a d.c. supply of the same voltage as the dynamo a resistor may be connected in the field circuit, as at X in Fig. 3, to reduce the field current, and/or a discharge resistor may be connected across the field windings as at Y. The resistor Y, which may have a resistance about equal to that of the field windings, may consist of a few lamps. This parallel resistor provides a circuit through which the electromagnetic energy of the field system can be gradually dissipated when the supply is cut off.

The field magnets of a compound dynamo may also be re-magnetised by passing a comparatively high current through the series field windings from a low-voltage source such as an accumulator. If a suitable battery is available this could, if required, be left connected across the series field windings whilst the dynamo is run up to speed. (See Fig. 4.)

Reversal of Terminal Polarity

In the event of the residual field magnetism of a dynamo being reversed the dynamo may build up voltage and behave quite normally with the exception that the terminal polarity is reversed. Moving coil ammeters and voltmeters connected to the dynamo would then read in the wrong direction and more serious effects might follow. Reversal may occur, and methods of correcting it are amongst the topics discussed in Part 2 of this article.

(To be concluded)

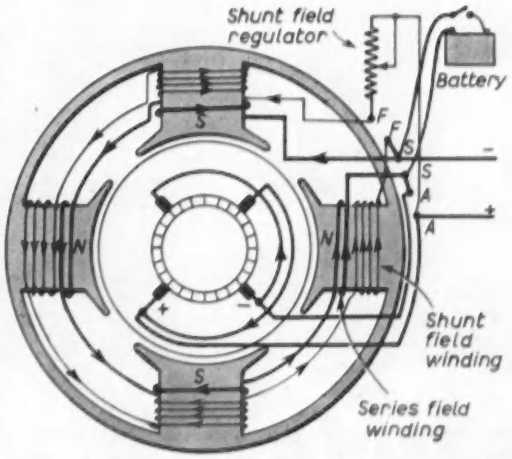


Fig. 4. Method of magnetising compound dynamo field system

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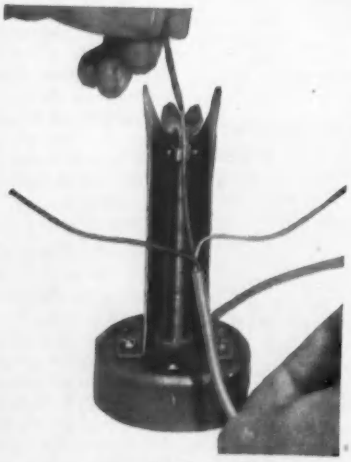

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Metropolitan-Vickers Type OSR Oil-Break Starter

DATA SHEET 15

THE Metropolitan-Vickers Electrical Co.'s Type OSR oil-break starter is designed to start and protect two- and three-phase slip-ring motors, 10-100 h.p. up to 650 V. The stator switch and rotor starter elements are operated by means of the same handle and the starter is equipped with an under-voltage release and no-volt no-close device. Two or three magnetic overloads with oil-dashpot time lags are fitted.

The starter is made in two models, OSR 60/100 and OSR 125/200 to B.S. 587:1940 (not more than two starts per hour) with the following maximum starting periods:

Up to 10 h.p. 10 secs.
10-50 h.p. 5 secs + ½ sec/h.p.
50-100 h.p. 25 secs + 1/10 sec/h.p.

Approximate size 21 in. x 14½ in. x 17½ in.
Oil capacity OSR 60/100 6 gal.
Oil capacity OSR 125/200 10 gal.

Construction

This starter is a typical, well made, heavy duty starter for industrial use. The internal arrangement is quite straightforward and the mechanism bears evidence of careful engineering design.

The main frame is of cast iron with provision for cable entries on each side and for busbar or isolator connections at the back, and provision for an ammeter on top. A large cast iron lid gives access to the terminals.

On the main frame are bolted cast iron side brackets which carry the drum controller and the resistance units (see Fig. 2) while a smaller pair of die cast frames carry the stator switch unit in the middle. The three overload dashpots and coils are mounted on the front of the starter and the racking mechanism and operating handle on the right hand side.

Very few pressings are used, most of the mechanical parts being die-cast with such refinements as bronze inserts in the bearing journals.

The first movement of the handle, i.e. towards "on" energises the no-volt coil (which is necessary for further movement the remaining part of the movement closes the stator switch contacts. The handle should then be racked down and up six times through about 20°, each racking motion inching the drum and taking resistance out of the motor circuit.

The last racking (i.e. the 7th) will leave the handle in the "on" position with the motor stator fed through the stator switch and all resistance out of circuit and the rotor shorted (there is no open position in the rotor circuit).

Movement of the handle downwards open-circuits the starter.

Note that in racking, after the initial stroke closing the stator switch, do not let the handle move too far, or the starter will be tripped. The pawl can be heard or felt engaging the drum teeth at each motion.

Under-Voltage Release. This is a normal a.c. magnet with a fully impregnated coil wound on a moulded former provided with a fixing lug. The coil is indelibly marked by a metal label. The magnet armature is spring loaded and open until energised. When the coil is energised the armature then acts as a latch to release the racking mechanism.

Overload Units. These are shown in Fig. 3 and consist of a tubular armature sliding in a split tube. The armature is coupled by a pivot to the piston rod carrying a floating steel disc spherically ground at the edges. Movement of the armature under overload operates a trip bar, common to all three units, via a striker pin. The trip bar releases the mechanism, mechanically via the linkage (F. Fig. 2) and not through the under-voltage coil.

Stator Switch Unit. Fig. 7 shows this. The main body is of moulded construction and the moving contacts elevated by a linkage operating on the pivots. The auxiliary contacts are mounted between the phase contact and must close first to energise the no-volt coil. Two compression springs return the moving contact body.

Drum Controller and Contacts. Illustrated in Fig. 4 of convention design and of adequate size for the necessary adjustments.

Resistance Units. Shown in detail in Fig 5. Ceramic former, wire wound, and supported on a steel bar.

Fig. 2. Exterior of OSR starter

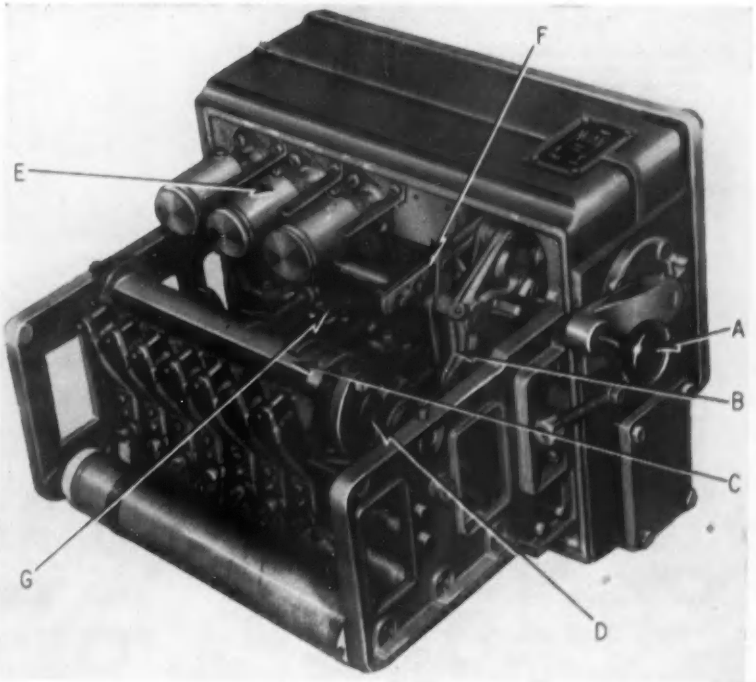
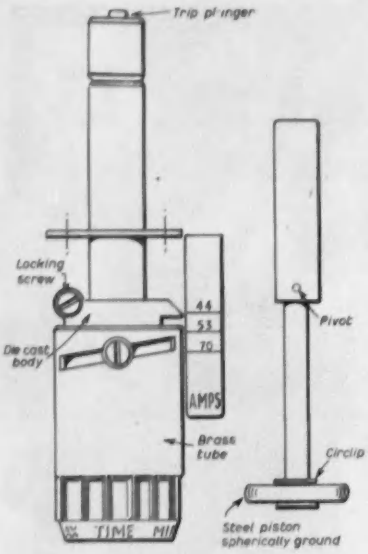
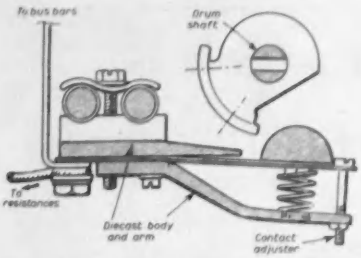
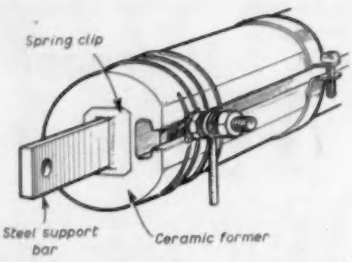


Fig. 1. General view of underside of starter. A, Handle (in "off" position); B, Linkage to stator switch; C, Drum controller for rotor resistance; D, Drum catch; E, Over-load dash pots; F, Over-load linkage trip; G, Stator switch







Left to right, Figs. 3, 4, and 5. Fig. 3 illustrates an overload unit, with the armature and piston shown separately. In Fig. 4 is seen the general arrangement of the drum controller and contacts. Fig. 5 shows the detail of a resistance unit

Maintenance

If the starter is not provided with an isolator, the starter must be dead before any operations are carried out. With the cover and oil tank removed the whole mechanism can be inspected. The whole interior can be reached if the switch unit is removed thus:

Remove the rotor connections at the side of the switch and then the four bolts (two on each side) of the resistance frame. If the two springs connecting the operating mechanism to the rotor drum are then unhooked, the rotor resistance, drum and contacts can be removed complete.

In operation, the surface of the stator switch contacts becomes rough and pitted, but this is not detrimental. Any large blobs of copper that may have formed should be removed, but it cannot be too strongly emphasised that it is not necessary to file the contacts to a smooth finish.

See that the stator contacts make (and break) simultaneously. The auxiliary contacts should make before the stop on the under-voltage release comes into action, otherwise the switch will fail to close.

Clean, and where necessary replace, the drum contacts and finger tips of the rotor starter. See that the rotor fingers press firmly on the rotor drum contacts. When contact is broken the fingers should drop approximately 3/32 in. Adjustment can be made by means of the adjusting screw near the finger tip; tighten the locking nut after adjustment.

Noise

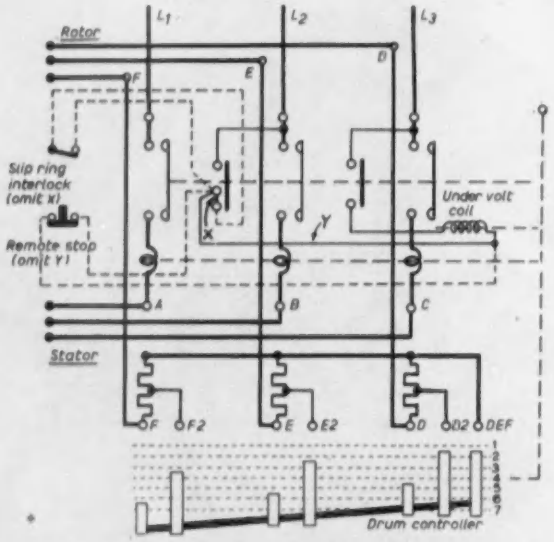
The under-voltage release should be reasonably quiet in operation; if there is more than a slight humming noise, the bedding of the armature and magnet face should be examined and any dirt removed. If noise persists, examine the small copper wire loop threaded through the armature and make sure that it is unbroken and that the soldered ends are intact.

The dashpots and oil must be clean and free from sediment. Fill dashpot (without piston) ¾ full with transformer oil B.S. 148:1951. The current rating should be set to 1½ approx. times full load current by releasing the locking screw shown in Fig. 3 and moving the whole body to the desired indicated position. Time lag can be varied by slacking the screw on the helical slot. Rotate to the left to decrease time.

Oil

The oil tank should be cleaned out, and the oil renewed every twelve months or at more frequent intervals if upon inspection much sludge is found, or the oil appears dirty.

N.B.—Attention must be drawn to the Instruction 5066/3 supplied with each starter. This book must be read carefully since it contains a clearly written routine test for checking the starter action.



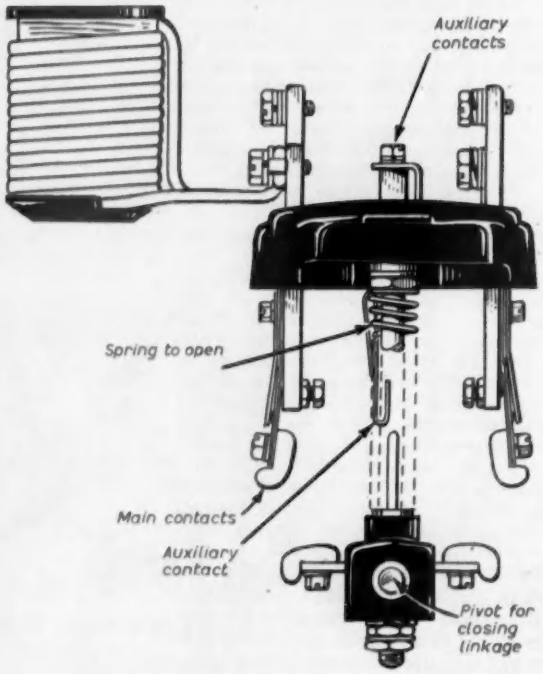


Fig. 6, above, shows the circuit of the starter. Fig. 7, right, gives a general view of the stator switch unit

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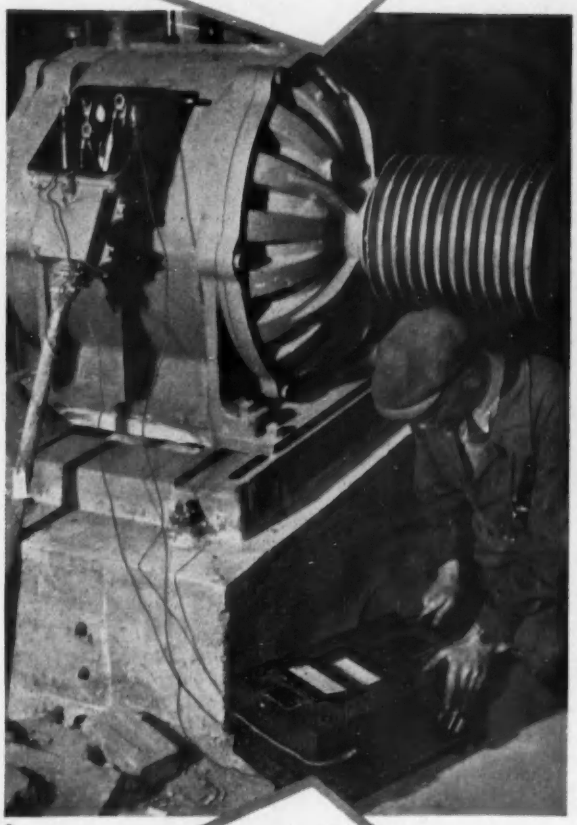

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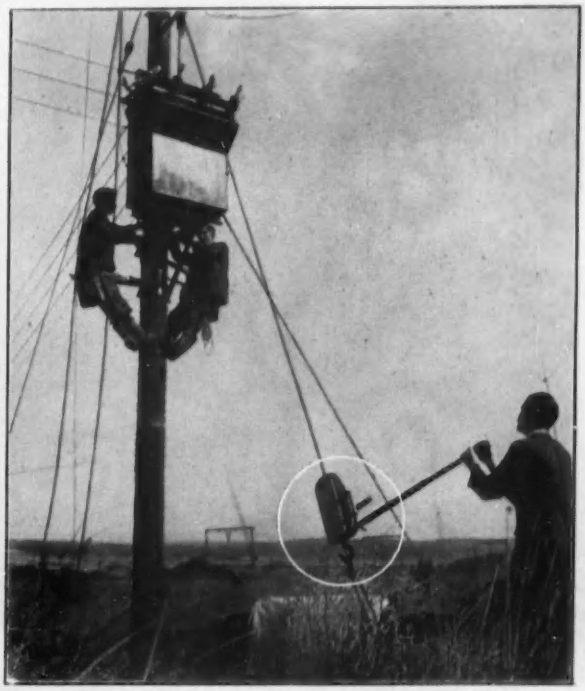

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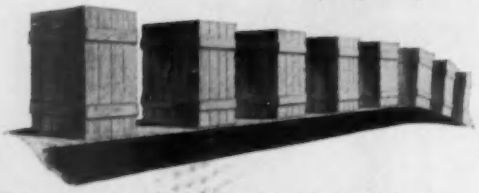

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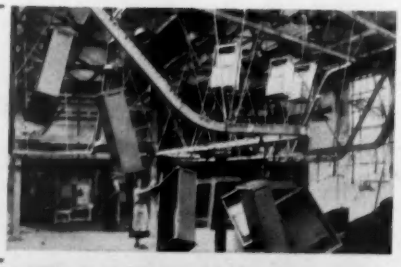

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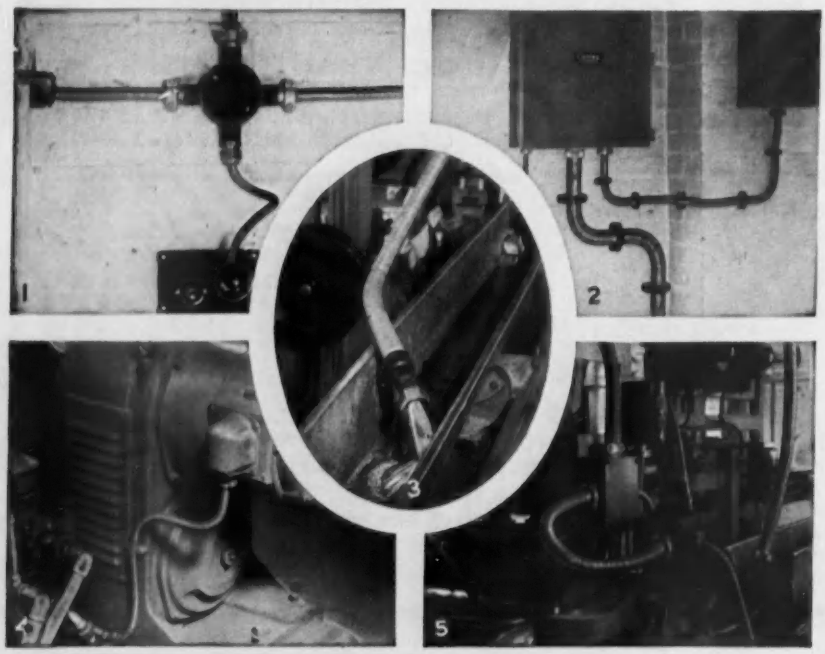

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Supplies for Electro-Plating

Metal Rectifiers and Motor Generators Compared

by D. W. TAYLOR, Graduate I.E.E.

THE initial cost of a complete rectifier set for electro-plating, including the necessary regulator and transformer, is about 40% higher than the initial cost of a similarly rated generator set. Yet in spite of this initial disadvantage, on all major electro-plating installations the metal-plate rectifier has ousted the motor generator set. An examination of the reasons for this has an interest for works engineers, who may have to initiate a small plating installation.

The first rectifier set of practical use in this line was of the copper plate type. This was an open construction air cooled unit. These sets are still used to a large extent in America, where fire laws prohibit the use of inflammable, oil-cooled units, without costly precautionary equipment being fitted. These sets, being of necessity open to atmosphere, were liable to corrosive attack, and as the size of plating installations increased the power demand was in excess of the largest practicable set. For these reasons this type of rectifier was not a suitable answer to the supremacy then held by the motor generator.

The development of the selenium plate rectifier unit, totally enclosed and oil cooled brought a new outlook to bear. This unit was about half the size of a similarly rated copper plate type, and it quickly established itself as the prime choice for the provision of d.c. power.

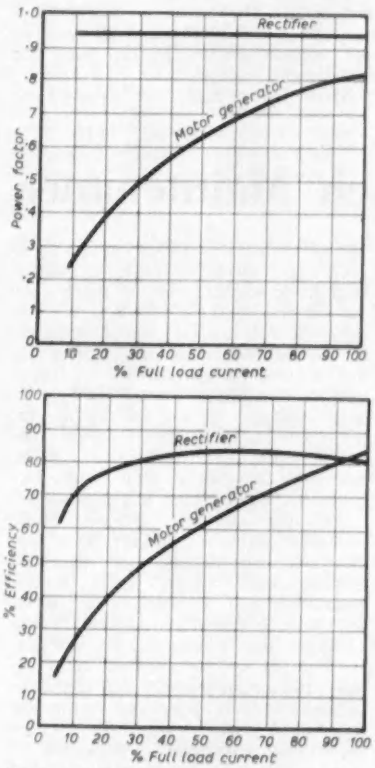
The reasons for its accepted supremacy are many and varied, but the main factors are quite clear and can be discussed under four groups: Efficiency, Installation, Maintenance and Control.

Efficiency

It is difficult to generalise on the relative efficiencies of rectifier and generator sets but taking an overall view of numerous sets at varying loads a comparison is possible. The efficiency of a generator rarely exceeds 80%, and falls off from this figure with decreasing load. The efficiency of a modern rectifier set, however, remains approximately constant over most working loads and is of the order of 80%. The power factor of the motor generator also gets worse as load falls off and even at full load rarely exceeds 0·8, whereas the power factor of the rectifier set is always above this figure. The curves in Figs. 1 and 2 give an indication of comparative p.f.'s and efficiencies for similarly rated rectifier and motor generator sets.

Apart from the efficiencies of the respective sets at the output terminals there is the overall efficiency of the installation to consider.

On old type plating plant the economy of initial installation often resulted in the practice of having one generator feeding several vats e.g. two or more electrolytic pre-plate operations and several varying plating vats. This was accomplished by supplying the vats from the generator via resistor boards, resulting in a low overall efficiency for the system due to the wasted power. The wide range of standard rectifier sets now obtainable makes it practicable to give every vat an independent source of supply and control. This increases the efficiency of the plant and gives minimum power consumption.



Figs. 1 and 2 show respectively the variation with load of power factor and efficiency for rectifiers and motor generators

Installation

The amount of special site preparation that is necessary for the "bedding down" of a generator set disappears and the positioning relative to the actual vat is simplified. The rectifier set is completely self-contained in an enclosed sheet steel tank usually mounted on rollers and thus can be quickly positioned on a normal floor or mounted overhead on a suitable steelwork gantry. An outdoor type is also manufactured as a standard, thus eliminating possible housing problems.

The siting of the generator set was largely influenced by the corrosive elements found in the locality of the plating plant. It was essential that the set with its vulnerable bearings, brush gear, windings, etc., was placed outside the zone of such elements. The rectifier set, due again to its total enclosure and static nature, can be made immune to such corrosive elements with protective paints. With this ability to position the rectifier sets closer to the vats comes the reduction in weight and cost of the installation of the copper or aluminium busbar necessary to carry the large current output to the respective vats.

Maintenance

A large d.c. generator set, like all rotating machinery, required constant attention to brush gear, bearings, etc., whereas the rectifier of modern design requires very little maintenance at all.

In the oil immersed unit the cooling necessary is affected by air or water. Air cooling, the more usual, is accomplished by means of cooling tubes on the outside of the tank, through which oil circulates by convection. Water cooling involves either a large water supply or a closed circuit with auxiliary pump, etc. The water is circulated in the top of the oil through a copper tube. The possibility of leaks must not be overlooked as the water pressure is obviously greater than the oil pressure, thus with the occurrence of a leak in the cooling coil, water would enter the rectifier tank.

These types of sets are completely self-contained with their related transformer and voltage control equipment. Once installed they can be left completely alone apart from periodic oil level and insulation checks and the application of a fresh coat of paint.

Control

It is necessary to control the d.c. voltage to the plating vats within quite fine limits and in this respect the rectifier set has a suitable reply to the generator.

The regulation of voltage, when using a generator set, was obtained either by varying the excitation voltage to the generator or, as previously mentioned, by the use of wasteful, adjustable, series resistances. The rectifier set has various means of control according to its size and the degree of control necessary for the particular process occurring in the vat

For the smaller type of set a tapped auto-transformer can be used, with its tapping switches mounted on its casing or mounted in some convenient panel to give remote control. It is possible, in some instances, to include this transformer in the main rectifier tank, size and weight being the limiting factors. The auto-transformer will give a stepped voltage regulation with the fineness of control governed by the number of tappings.

The larger type rectifier sets can be controlled by induction regulators, moving coil regulators or by specially designed auto-transformers. A moving coil regulator is usually the choice of control for very large output sets, where size and weight make the application of other methods impracticable. All these controllers can be arranged for hand operation or motor drive by remote control. This latter method is the usual type employed with automatic plating plant where control of all equipment associated with the plant is centralised and in the hands of one or two operators. The regulation obtained with these three types of controller is virtually stepless.

Although not truthfully part of the control equipment an essential item of a rectifier set is the "step-down" transformer to supply the rectifier with the correct a.c. voltage for the necessary d.c. output. Here again on small sets it may be mounted in the same tank as the rectifier, limiting factors being size and weight.

There is one final point to affect the decision when considering what equipment is best installed, namely, the cost. Once again it is very difficult to generalise on this subject but average figures can be computed. As already mentioned, the initial cost of a complete rectifier set, i.e., with regulator and transformer, is about 40% higher than the initial cost of a similarly rated generator set. The power consumption of the rectifier feeding individual vats is about 50% less than the generator; the reasons for this are clearly seen in the preceding sections of the article.

Is Too Much Maintenance Harmful?

MOST writing on the maintenance of electrical equipment advocates inspection and overhaul of plant and apparatus at preplanned intervals to check that it is not deteriorating in quality. For some types of equipment, however, there is growing support for the "let well alone" school of thought. This clash of ideas was discussed recently at a meeting of the Institution of Electrical Engineers when a paper was read entitled "Maintenance Principles for Automatic Telephone Exchange Plant." The author is Mr R. W. Palmer, M.I.E.E. (Post Office Engineering Department).

In this paper consideration is given to experience with and without overhauls: and although it is specifically telephone equipment that is mentioned, much of what is said has some application to automatic control equipment generally, and all of it gives food for thought to the plant engineer.

First of all, the case for overhauls. There have been some remarkably successful results in British telephone exchanges recently with concentration on the quality of mechanical overhauls above all other maintenance operations. However, to make this possible without increasing the staff, functional testing was either abandoned or drastically reduced.

In complete opposition to this experience is the action of the Bell system in America, who have ceased regular overhauls of step-by-step mechanisms. They have operated a rather elaborate fault-analysis scheme to bring defects to notice, but the maintenance man is not expected to do any more than is necessary to clear each observed defect (actual or suspected) leaving everything else undisturbed. In Sweden there is a somewhat similar outlook for certain items of plant. A so-called "overhaul" is given every few years, but it consists almost entirely of meticulous cleaning without readjustment. Each mechanism is washed with a cleaning fluid to give an extremely high standard of cleanliness. The only adjustment check is a measurement of bearing wear.

These practices recall experiments by a British manufacturer, who tested step-by-step selections without maintenance readjustment or overhauls over than lubrication and bank cleaning. At the end of two million operations (effectively 40 years' life) there had been one service failure per selector every 4½ years. Then the test was repeated with a new set of selectors, with overhaul and readjustment at the equivalent of yearly intervals. Faults found during overhaul on inspection were classed as routine plant faults: only stoppages of the test cycle were listed separately as service failures. There was no reduction in such service failures: they were 2½ times as great as when no preventive maintenance was applied.

Although such tests cannot simulate exchange conditions entirely, they indicate that the bearing and impacting surfaces will "bed-in" if a selector mechanism can be allowed to remain undisturbed. The switch is then capable of many years service without overhaul.

Summing up the apparent contradictions, the author remarks that experience suggests that for telephone type equipment good service is dependent on good mechanical condition, irrespective of what testing and other maintenance work is performed. If plant is not in good adjustment appropriate to the demands made on it, a single and thorough overhaul is necessary to make it so: thereafter it will give the best result if left alone so long as it is giving satisfactory service.

Mr Palmer in his paper goes on to discuss many test methods special to telephone exchange working, which need not concern us here. In his final section, however, he gives consideration to the general principles of maintenance, and here he has much of interest to say. He emphasises that both design and maintenance efforts are interwoven in the pattern of performance in service, and he suggests that there are three main objectives for maintenance work in terms of its contribution to "quality of service."

Prevention of service failure (including prevention of plant faults).

Disclosure and location of service failure.

Correction of service failure (and of plant faults).

Again, it must be emphasised that the telephone-system approach is being adopted. Quality is improved as much when the number of plant faults is halved as when the number of calls lost by each plant fault is reduced by 50%: but this is a situation familiar enough in other fields of electrical maintenance.

Ultimately, a routine maintenance policy is a prominent feature of the accent on preventive maintenance, and routine functional testing usually accompanies it to show up faults. Routine work has the advantage that it is more easily controlled by the higher levels of supervision: its disadvantage is that it tends to focus attention too much on arrears of routine, rather than on shortcomings in quality of service.

"Qualitative maintenance" is an alternative. The term implies that the work performed is varied locally according to the current state of individual items of plant, the quality of the service, and the skill and temperament of the available technical staff. The stress is on economy in effort, and substantial savings in expenditure seem to be possible as a result.

Discussion

Speakers in the discussion presented many varied views on the approach to maintenance. One G.P.O. speaker said that the British Post Office were satisfied as a result of field trials that they had in the past overdone the amount of attention given to equipment. They were impressed by the evidence in favour of the "let it alone" school and were moving in that direction. Such a move was welcomed by an engineer on the manufacturing side: however, he emphasised the need in such an approach to ensure that too much was not demanded of equipment, either by the circuit in which it was connected or by the physical conditions in which it worked. Another such engineer said that overhauls were only worth while if the staff concerned was well selected, expertly trained, interested, and had unlimited time. In other cases they did more harm than good.

In regard to seemingly contradictory results, a speaker underlined the effect of any new methods in arousing the interest of the staff, and so leading to an incidental improvement. The final speaker, Sir Gordon Radley (Engineer-in-Chief, G.P.O.), was non-commital: he felt that both preventive and qualitative maintenance were capable of giving good results.

Electricity Flourishing in Victoria

Plant Shortage Overcome and Tariffs Reduced

A MOST successful year, both technically and financially is reported in the 35th Annual Report of the State Electricity Commission of Victoria, for the period 1953-4. Highlights from the Report are that the sales of electricity increased in the period reviewed by no less than 16%, almost twice the previously recorded highest increases. Some 33,000 new consumers were supplied by the Commission, including 4,800 farms; while brown coal production reached eight million tons—the highest figure yet recorded. New plant capacity installed was 136 MW, bringing the total to 811·5 MW, and the plant was adequate to meet the large increase in electricity requirements.

Financial

The healthy state of the Commission's finances is shown by the surplus for the year of £359,494 after providing full interest and depreciation, strengthening the reserves to the extent of £250,000 and meeting £1,250,000 on account of interest and other expenditure arising directly from the need to defer certain capital works because of insufficient loan funds. Income from all sources totalled £23·68m, an increase of £2·94m (14%) while expenditure was up by £2·99m (16%).

The continued successful financial result, coupled with the prospect of more stability in cost levels, enabled the Commission to reduce residential tariffs as is from 1 July, 1954, and public lighting tariffs as from 1 Oct.

Power Plant

The Morwell power and fuel project is now proceeding to a revised programme. Stage 1 to be completed by Jan. 1958 includes two boilers, one 30 MW h.p. turbo-generator and one 20 MW l.p. set. Power output to the system will be 42 MW. By Jan. 1959, stage 2 is to be completed and involves two additional boilers, a 30 MW h.p. turbo-generator, and the completion of the first briquette factory. Output will be 714,000 tons of briquettes/annum and power output 66 MW. Jan. 1960 is the target date for stage 3, and again involves two boilers, one 30 MW set, and the erection of the second briquette factory. Output of briquettes will rise to 1,564,000 tons of briquettes/year and available output of electricity will be 91 MW. The final stage includes two more boilers, one 30 MW h.p. set, and one 20 MW l.p. set bringing the available output to 133 MW by 1961.

Development subsequent to stage 3 will be reviewed and made the subject of a report to the government in about 3 years' time.

Other generating plant on order or approved includes a 50 MW steam set for Yallourn (1955), two 50 MW sets for 1957/58 and one 6 MW set for 1956. A 40 MW steam set is on order for Newport and two 25 MW water turbine sets for Hume Weir are to be installed by the Electricity Commission of New South Wales, the output to be shared equally by New South Wales and Victoria. Two 60 MW water-driven sets are planned for operation in 1956 at the Eildon Dam.

Kiewa Project

Work on the large dams at Rocky Valley and Pretty Valley, on which the scheme is fundamentally based, has been in abeyance for some considerable time; however, since the close of the year a re-commencement has been made on the Rocky Valley Dam.

No. 1 (Upper) Development has been carried forward, and the French firm, Société Etudes et Entreprises, has excavated 13,035 ft of the headrace tunnel (70%). No. 1 power station has been relocated as a surface station and will comprise five 16 MW turbo-generators with provision for the possible installation of a sixth machine. Site works for the power station building and pipe-line have started.

A preliminary study of the various alternatives for No. 2 development has been completed but no work has been carried out in this section. The Bogong station (No. 3) which has been running for some ten years now receive additional water from the Bogong Creek raceline.

Most work has been concentrated on No. 4 development with a planned capacity of 61·6 MW, where the erection of the four 15·4 MW sets is proceeding. The headrace tunnel was completed and the concrete lining of the tailrace tunnel was 90% complete. The station should be finished during this year.

Smaller Stations and Distribution

The new power plants at Geelong (three 10 MW sets) Ballarat (four 5 MW sets) and Redcliffs (two 5 MW sets) all comprise "packaged" steam-electric sets ordered from U.S.A. in 1951. Shepparton station comprises three 1,850 kW and six 830 kW diesel generating sets and Warrnambool six 830 kW diesel sets. All these stations are complete and were brought fully into operation during the year.

The first circuit of the new Yallourn-Melbourne 220 kV line (67 miles long) is now complete and is operating temporarily at 132 kV and the Kiewa-Melbourne 220 kV transmission line (153 miles long) will be in operation early in 1955. Feeders to link the new West Melbourne Terminal Station and the augmented Spencer St, Melbourne, power station are complete. At Brunswick Terminal station the second 40 MVA synchronous condenser and two 37·5 MVA transformers and associated switchgear were installed. The redesigned switchyard at Thomastown Terminal Station was nearly completed and two 10 MVA transformers are erected.

In 1951, the Commission's report on the final phase of the rural electrification of Victoria was presented to Parliament. This provided for 178,000 consumers outside the metropolis to be connected, leaving at the end of the period some 15,000 homes in the most isolated part of the state without a supply. Considerable progress has been made toward the fulfilment of this programme and work is now ahead of schedule. At 30 June, 1954, more than 581,000 dwellings were supplied with electricity in the State of Victoria leaving 71,000 without a supply. Of these 13,600 are within the area served by the Metropolitan Branch, and 57,700 are outside the metropolis including the 15,000 houses in rural parts.

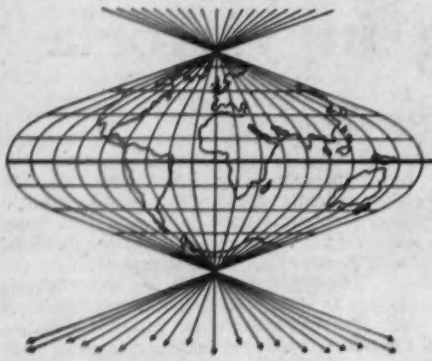
Tariff Reductions

With the continued satisfactory financial result of operations, the Commission reviewed its standard tariffs. A reduction of 2d. per room per month has been made in the service charge for all consumers taking supply under the residential two-part tariff "G" with effect on bills rendered on or after 1 July, 1954. This will result in an overall benefit of £300,000 per annum which will be shared by 550,000 residential consumers. Also Municipal Councils have been assisted in their efforts to improve street lighting by a reduction of approximately 10% in public lighting tariffs with effect from 1 Oct., 1954. As a result, municipalities served by the Commission throughout Victoria will benefit to the extent of £33,500 per annum.

Electricity sold to all consumers—retail and bulk—totalled 2,815 million kWh, an increase of 16% for the year, compared with 8% during 1952/3. This large increase, almost twice the highest previously reported, is partly due to the 7% increase in the number of consumers. There has in addition been a substantial increase in consumption by existing consumers reflecting a greater application of electricity, particularly for power and heating in industry and commerce.

Sales to domestic consumers increased by 17·8%, and there were 27,290 new consumers in this class. The average cost per unit sold to domestic consumers for all purposes is today lower than in the pre-war period, although since 1939 the basic wage has trebled.

Sales to commercial and industrial consumers increased by 15·1% and 19·4% respectively. The number of consumers in these classes increased by 3,359 and an additional 44,115 h.p. of motors was connected.



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Control of Rivers

After a bitter, wordy battle, the Canadian House of Commons has approved, by 178 votes to 16, the International Rivers Bill, which gives the Federal Government authority to control works on international rivers. It has thus blocked the proposed arrangement between the British Columbia Government and the Kaiser Aluminium Co. under which a dam would be constructed on the lower Arrow Lakes, in B.C. to provide water for a power station to be constructed at Bonneville, in the U.S.A. Mr Bennett, Premier of British Columbia, is indignant at this change in the plans, it seems, and may take the matter further.

AMERICA

Undercut by Foreigners

Foreign manufacturers of electrical equipment could undersell American producers by up to 40%, Mr G. Price, president of the Westinghouse Electric Corporation, told the U.S. Senate Finance Committee when referring to the Foreign Trade Bill last week. In his view the installation of foreign built equipment in the United States created a national risk of the first magnitude. He alleged that it was inferior in quality, and that foreign companies could not satisfactorily handle maintenance and repairs.

Supplying a New Suburb

The Cuban Government has granted concessions to provide a new suburb of Havana with electricity, gas and drinking water. The concessions, which run for 50 years, were granted by decree to the Compania Electrica del Este de la Habana, S.A.—for the construction of the necessary gas and electricity plant and distribution systems—and to the Compania de Abastos de Agua del Norte, S.A.—for the construction of a waterworks network. The new suburb is to be built across the bay from Old Havana. It is expected to cover an area of several million sq yd.

BARBADOS

New Steam Station

With the successful completion of negotiations with the Colonial Development Corporation concerning new capital, the Barbados Electric Supply Corporation Ltd. is about to embark on a programme of expansion. First on the list is the establishment of a new steam power station, which, initially will have one 2,500 kW turbo-alternator and an oil-fired boiler installed. Consulting engineers for the work are Ewbank and Partners, and we understand that contracts for the plant are now being negotiated. The new station, which it is hoped will be in commission late in 1957, is to be erected alongside the existing 7,044 kW diesel station. Provision is being made for extensions totalling up to 20 MW as required. Seawater will be used for cooling purposes, with a recirculation arrangement to prevent marine growth. It is not proposed to discontinue the use of the diesel power station when the steam station is in operation—the diesel sets will supplement the steam plant for many years to come.

AFRICA

Report on Shire Valley

A report on the Shire Valley project in South Nyasaland, prepared by Sir William Halcrow and Partners, has been issued by the Rhodesian Federal Government this week. It proposes water control, a hydro-electric scheme, and marsh reclamation. Total cost is estimated at nearly £80 millions. The report emphasises that the whole project demanded development of hydro-electric power, and in the first stage of the scheme the construction of a barrage and power station at Matope is envisaged.

Bright Outlook

Looking to the future, Sir Charles Westlake, chairman of the Uganda Electricity Board, estimates that if the demand for electricity in East Africa continues to increase at its present rate, 500 MW will be needed to meet requirements in 1975. In his view that demand could be met only by local hydro-electric stations, with the balance coming from power resources on the Nile. Capital involved might amount to as much as £100m, but that must be found if progress was to continue uninterrupted. He also referred to the experiments which had been carried out by the Uganda Government for more than a year in the Ruwenzori Mountains where there were hot springs, although no satisfactory result had yet been achieved from the drilling. There were similar springs in Kenya which might prove satisfactory, he said. Sir Charles was addressing members of the East African Association of Engineers, of which he is president.

IRAQ

Baghdad's Position

The likelihood that the undertaking of the Baghdad Light and Power Co. may shortly be nationalised by the Iraq Government is once again raised by a report from Baghdad that a four-Minister Committee has been set up to study the matter. The committee consists of the Ministers of Justice, Economics, Finance, and Communications and Works. We understand, however, that the official intimation of any such investigation has not been received at the undertaking's office in London. It may be recalled that a Ministerial Order was passed by the Cabinet in July, 1953, for nationalisation of the undertaking, but subsequently the Cabinet resigned. Its successor took no action, and the present Cabinet has given no other indication of intentions, although the company has asked for a clarification of the position in order that development is not stultified. The company has a fifty-year concession from June, 1928, at the expiration of which the works and plant would become the property of the government without charge, while the government has the right to purchase the undertaking as a going concern at the end of any five-yearly period from 31 Dec., 1954.

S.W. ASIA

Diesels in Pakistan

A new diesel power station at Chittagong was recently inaugurated by the Governor of East Pakistan, Mr Shahabuddin. The station, which is now only in partial operation, is to have sixteen sets with a total capacity of 10,000 kW. It is scheduled for completion by the end of this year.

Objection Raised

Without any protection regarding "fair" compensation in the event of acquisition, the prospects of electricity undertakings continuing to embark on costly ventures such as the building of new power stations or the expansion of existing ones would be difficult—that

is the view of the Federation of Electricity Undertakings in India. The Federation is referring specifically to an Amendment Bill, just introduced, which seemingly, would enable any State Government to repeal the provisions for fair compensation contained in the Indian Electricity Act, 1910. It is suggested that this new Bill has been introduced to safeguard the Madras and Andhra Electricity Undertakings (Acquisition) Acts, 1954—which provides for compensation considered as unfair by the Federation.

AUSTRALIA

Tasmania's Next Scheme

The site of the next large hydro-electric scheme for Tasmania has been under discussion recently. Mr Cosgrove, the Premier, has said that the reports of field geologists, engineers and surveyors operating in the west coast area was awaited. If that area was chosen, he said, it would probably be necessary to seek parliamentary approval for the initial expenditure this year.

Estimating Future Demands

A special technical committee has been set up in Queensland to investigate the demands for electricity up to 1956, and the probable needs up to 1970. Among other things the committee is to consider the possibility of further development of the Tennyson and Bulimba "B" power stations beyond the present building programmes. It is also to investigate the quantity and source of fuels required for future generating stations. The adequacy of existing inter-connection facilities between the Brisbane City Council and the Southern Electric Authority systems, and the possibility of future inter-connection with the system of the Wide Bay-Burnett region. The State Electricity Commission, the Southern Electric Authority and the Brisbane City Council would be represented on the committee.

Changing Fuel?

Faced with increasing costs of coal supplies from the Collie region, officials of the Kalgoorlie Power and Lighting Corporation Ltd. are now considering the possibility of reverting to wood chip fuel to fire its boiler plant. The company, which supplies power to gold mines and other undertakings at Kalgoorlie, Western Australia, undertook a reorganisation about four years ago, when, envisaging a big increase in the demand for power from the goldfields, it was decided to turn over to coal firing and installed additional plant. Unfortunately, by the time the conversion was completed, some of the larger mines had installed their own diesel plant. Efforts have since been made to obtain additional load, to effect economies and improvements in operation. At present the power plant is consuming about 40,000 tons of coal annually. It is believed that reversion to wood chip, using about 1,000 tons a week, would lower costs.

NEW ZEALAND

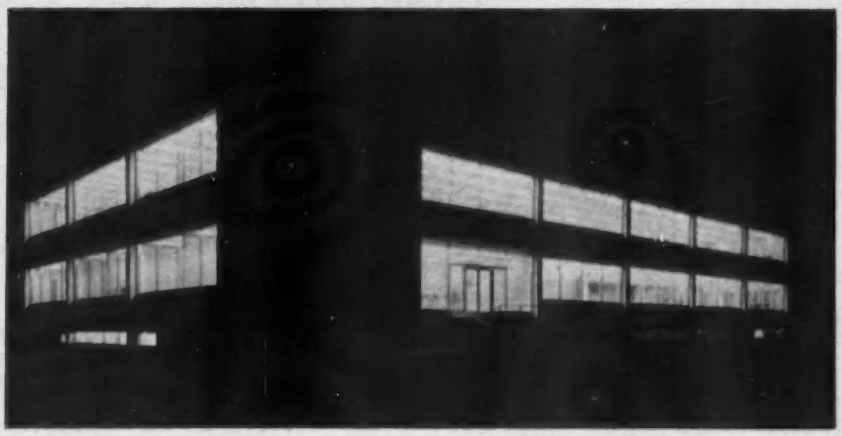
Cable Imports

The New Zealand Customs Department has rejected an application to import cable to be used by the Auckland Electric Power Board. The latter's contractor for the supply of 25,000 yd of braided cable wanted to import it from Australia, but the Customs Department maintained that a suitable plastic-covered cable was produced in New Zealand. But Mr N. M. Speer, general manager of the Power Board, consjdered that braided cable was better than the other suggested. In any event, the Board's officers prepared specifications and made recommendations, and he objected to someone in Wellington telling them to use something else. Mr Speer estimated that the Australian cable would cost about 10% more than the N.Z. product. The Board has decided to apply again for an import licence.

SCOPE FOR EXPANSION IN MANITOBA

NOTABLE for its expansion in the past decade, particularly in the rural electrification sphere, the Manitoba Power Commission provides an electrical service to 480 cities, towns and villages and over 39,000 farms scattered throughout a very wide area. The total length of transmission lines, in fact, is over 29,000 miles, it is noted in the Commissioner's report for the year ended 31 Mar. last. It is not surprising then that more frequent storms caused an increase in service interruptions. For the service crews, 55 field trucks are now fitted with two-way radio communication apparatus to improve coverage of the system. A feature of the rural electrification programme, which was initiated in 1945, is that most consumers submit their own monthly meter readings. Altogether 35,856 did this in the year under review, and the annual audit of these meters revealed an insignificant number of errors, it is stated. This electrification scheme has resulted in over 75% of the farms in the province now having a power supply from a central station. A further 2,500 farm extensions are scheduled for the current year, after which only the most isolated groups will remain. Incidentally, the high cost of extending the service to these consumers is often reduced by the farmer voluntarily cutting the brush along the transmission line right of way to the pole in his own yard.

The commission, which is concerned solely with transmission and distribution, was supplying 95,879 consumers at the end of Mar. last, compared with 27,170 in 1945. Total consumption in the year amounted to 353·2m units—an increase of nearly 20%—of which domestic and farm consumers accounted for 164·2m units. This expansion has necessitated an extensive programme to increase transmission, substation and distribution capacity, and a new terminal station has been built at Brandon, with a rated capacity of 60 MVA, in which 115 kV air blast circuit-breakers are installed. It has meant an expansion in other work also, and at long last the commission has a home of its own—a new head office building on Portage Avenue, Winnipeg, was occupied a few weeks ago. It is of reinforced concrete construction, functional in design yet distinctively modern. The banks of fluorescent lighting make an impressive sight at night time, as our illustration below shows. In addition to extensive office accommodation, the building includes spacious showrooms and a model kitchen.



The new head office, in Winnipeg, of the Manitoba Power Commission

Personalities IN THE INDUSTRY

Taking up his new duties as district commercial engineer, West Ham district of the London Electricity Board on 1 Apr., is **Mr J. H. M. Barrett,** A.M.I.E.E., who, latterly, has held a similar position in the Board's Forest district. Educated at Beckenham County School and Croydon Central Polytechnic, he gained early training with Beckenham Council Electricity Department. After war service, from which he retired with the honorary rank of Major in R.E.M.E., he rejoined the Beckenham undertaking as sales engineer, and after vesting day became first assistant district commercial engineer, Beckenham/Bromley district of L.E.B.

Mr A. de M. Browne, B.SC., A.R.C.SC.I., has been elected to the board of Switchgear and Cowans Ltd. Mr Browne, it will be recalled, is also chairman and managing director of the Hackbridge and Hewittic Electric Co., Ltd., with which group he has been associated for over 30 years.

Further appointments in the Sales-Service organisation of Hoover Ltd. are announced. **Mr C. A. R. Hardwick,** previously a supervisor in the Romford district, is to be district manager for Portsmouth, and **Mr P. A. D. Duffell,** formerly a regional manager, is to be district manager for Westminster.

Changes in the organisation of the department of the chief mechanical engineer (railways) of London Transport, which took effect this week, have been made to give officers of the department wider experience. They concern **Mr G. S. Bingham,** M.I.MECH.E., M.I.LOCO.E., M.INST.T., previously assistant mechanical engineer (Running), who has been appointed assistant mechanical engineer (Works), and **Mr J. G. Bruce,** B.SC.(ENG.), M.I.E.E., M.I.LOCO.E., M.INST.T., formerly assistant mechanical engineer (Works), who is now assistant mechanical engineer (Running). Mr Bingham, who is 48, joined the chief mechanical engineer's department of the London Electric Railway Co. in 1922 as an apprentice. He became depot engineer at Ealing Common depot in 1946, and a divisional depot engineer three years later. He took up his present appointment in 1950. Mr Bruce, who is 41, entered the service of London Transport in 1935 as an engineering trainee and was appointed to the technical staff two years later. After serving as section controller in charge of Northfields depot and as assistant production engineer at Acton works, he was appointed production engineer at that works in 1949. In 1951 Mr Bruce visited the United States under the auspices of the Economic Co-operation Administration in order to obtain experience of American production methods. On returning from this visit he became progress and planning engineer and the following year he was appointed to his present position.

At the recent Railway/Traders' Panel Meeting in London, **Mr P. V. Gurr,** J.P., representative of the Folkestone Chamber of Trade, vacated the office as chairman, having completed the maximum period of two years allowed under the Panel Rules. **Ald. G. Pycroft,** M.B., CH.B., of Bexhill Corporation, was elected chairman, with **Ald E. E. L. Arkell,** J.P., of the Croydon Corporation, as vice-chairman. Mr Gurr is, of course, district manager at Folkestone, to the South Eastern Electricity Board, and Alderman Arkell is chairman of the Croydon and West Kent Consultative Committee.

The new chief commercial officer of the East Midland Electricity Board is **Mr T. G. Blayney,** D.L.C., A.M.INST.F., who has been liaison officer of the Board since 1948. Educated at Ashley Grammar School, Mr Blayney received his technical training at Loughborough College and joined the Derbyshire and Nottinghamshire Electric Power Co. in 1922. For some years prior to vesting day he was personal assistant to the general manager of the Midland Counties group of power companies.

District engineer for No. 104 district western sub-area of the South Wales Electricity Board, **Mr F. R. Gregg,** ASSOC.I.E.E., has been nominated as the next Mayor of Lampeter by the town council. He has been a member of the council for nine years.

Among four new members appointed to the University Grants Committee by the Chancellor of the Exchequer is **Dr Willis Jackson,** director of research and education, Metropolitan-Vickers Electrical Co., Ltd.

Chairman of British Industrial Plastics Ltd. since 1933, **Mr K. M. Chance** has decided to relinquish that position "to make way for a younger man to take his place." **Mr E. R. Crammond** has agreed to accept the position. Mr Chance is remaining with the company as vice-president.

The Midlands Electricity Board announce that **Mr Donald Holt,** B.SC. (TECH.), M.I.E.E., now manager of the Board's Central Gloucestershire sub-area, is being transferred to a similar post in the Wolverhampton and District sub-area on 23 May, in succession to **Mr F. J. Elliott,** M.I.E.E., who is retiring. Mr Holt, who is 53, was born at Birkenhead and educated at Rochdale and at Manchester University, where he graduated. He was trained at Rochdale Corporation Electricity Department and was assistant mains superintendent at Rochdale from 1930 until 1933, when he was appointed district engineer in the electricity supply undertaking at Walsall. At Walsall he was successively mains superintendent (1934-42), chief assistant engineer (1942-46), and engineer and manager

Mr J. H. M. Barrett

Mr J. G. Bruce

Mr T. G. Blayney

Mr D. Holt

Mr F. J. Elliott

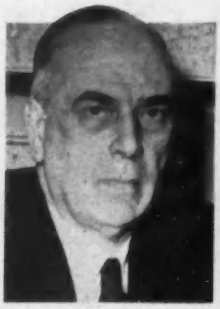
(1946-48) and while holding the latter appointment he was a member of the West Midlands Joint Electricity Authority.

Following the formation of the Midlands Electricity Board in 1948, Mr Holt served as manager of the Board's Walsall and Wolverhampton Districts until his appointment as manager of the Central Gloucestershire sub-area in Jan., 1950. During his five years in Gloucestershire Mr Holt has been responsible for an extensive rural development programme, as the result of which upwards of 70% of the farms in the sub-area are now on supply, almost twice as many as were connected in 1948. He is now returning to manage a predominantly industrial sub-area, in which he has already had considerable experience. Mr Elliott, who has been manager of the Wolverhampton and District sub-area since the M.E.B. was established in 1948, was born at Bristol and was educated at the Merchant Venturers Technical College and at University College, Bristol. From 1910 to 1930 he was on the staff of the Bristol Corporation electricity undertaking, of which he became assistant mains engineer. Going to Wolverhampton in 1930 he was successively chief assistant engineer (1930-35), deputy engineer and manager (1935-44), and borough electrical engineer and manager (1944-48). He also served as a member of the West Midlands Joint Electricity Authority.

Mr E. J. Shuter has rejoined Claude-General Neon Lights Ltd. as London sales manager. Mr Shuter joined the General Electric Co., Ltd., in 1927, and inaugurated in 1929 the signs section of the Fittings Dept. He later transferred to the Claudgen organisation, where he stayed until the outbreak of war in 1939. Since then, he has been with the G.E.C. sales organisation first as technical representative and subsequently as sales supervisor responsible for hotels, theatres and large stores.

Previously district commercial engineer for the Leyton district, in the North Eastern sub-area of the London Electricity Board, **Mr R. C. Gordon,** ASSOC.I.E.E., has joined the South Eastern Electricity Board as senior assistant commercial engineer at the Croydon and West Kent sub-area headquarters.

At present manager of the York sub-area of the North Eastern Electricity Board, **Mr W. A. Crocker,** M.I.E.E., has been appointed to a similar post at the Board's Tees sub-area, in succession to **Mr S. Tillotson,** A.M.I.E.E., who, as we have already noted, retires at the end of this month. Mr Crocker was educated at Bradford Technical College and trained with the Bradford Corporation Electricity Department. He subsequently served with electricity undertakings at West Ham, Plymouth, Stretford and Birkenhead, before becoming city electrical engineer at York in 1946. On nationalisation, he became manager of the York sub-area.



Mr E. B. Dillow

Mr R. L. Saunders

Mr D. Scott

The Minister of Fuel and Power has appointed **Mrs E. Gregory,** O.B.E., J.P., of Basildon, Essex, as a member of the Eastern Electricity Consultative Council. Mrs Gregory was formerly a member of the London Electricity Consultative Council.

Manager of the Brisbane City Council's Electricity Department, **Mr P. A. W. Anthony,** B.E., M.I.E.E., is resigning that position as from 30 June next, in order to take up the post of manager of the Southern Electric Authority of Queensland from 1 July. Mr Anthony has been manager of the Brisbane undertaking since October 1951, having been its chief engineer from May 1950. Earlier he was manager of the Cairns Regional Electricity Board.

Mr T. Counter has been appointed as head of the Appliances and Installation Equipment Division of B.E.A.M.A. He was previously with the British Standards Institution. Mr Counter succeeds **Mr A. H. Gambling** who has taken up a post as personal assistant to the managing director of Hartley-Baird Ltd. Joining B.E.A.M.A. in 1946 as secretary of the Domestic Electrical Appliances Section, Mr Gambling became secretary of the Associated Manufacturers of Domestic Electrical Appliances, and of the Associated Manufacturers of Domestic Electric Cookers when those two associations were formed in 1949.

Cable and Wireless Ltd. announce the following appointments to take effect on 1 April: **Mr W. J. Knight,** M.B.E., formerly assistant engineer-in-chief, is to be deputy engineer-in-chief in place of **Mr E. B. Dillow,** who retires on 31 March. **Mr R. L. Saunders,** B.SC.(ENG.) and **Mr D. Scott** are to be assistant engineers-in-chief in place of Mr Knight. Mr Saunders is now engineer in charge of the company's development laboratory and production unit at Radio House, Wilson St, London, E.C.2, and Mr Scott is responsible for the day-to-day operations of the company's world-wide network of wireless circuits. Mr Dillow joined the Western Telegraph Co. in 1913 and served as an engineer at Madeira, St Vincent (C.V.I.), Gibraltar, Malta and Carcavelos (Portugal). He joined the company's engineer-in-chief's department in 1927, and transferred to Cable and Wireless Ltd. in 1929. He was appointed assistant engineer-in-chief in Jan., 1950, and promoted to deputy engineer-in-chief a year later. Mr Knight, who also started with the Western Telegraph Co. in 1915, is an expert in cable duplexing. He has been assistant engineer-in-chief since 1951.

Mr N. F. T. Saunders (General Electric Co.) has been elected chairman of the British Refrigeration Association to succeed Mr R. H. Hemmings. **Mr R. G. Brandon** (International Refrigerator Co.) has been elected vice-president.

Mr C. C. Inglis, M.I.MECH.E., M.I.E.E., chief research officer, British Transport Commission, has been elected president of the Faraday House Old Students' Association.

OBITUARY

Mr J. S. Simmons, formerly advertising manager of the Henley Organisation, died on 8 Mar. He retired from that position in 1946. Prior to becoming advertisement manager of the Engineering Advertising Dept. of the parent company, W. T. Henley's Telegraph Works Co., Ltd., he founded Henley's house journal, *Distribution of Electricity*.

Mr A. S. Markes, A.M.I.E.E., who died on 5 Mar., aged 78, had a long and varied experience in the Electrical Industry. He served with Veritys Ltd., and Metropolitan-Vickers Electrical Co., and for a time was in business as a consultant. He will be remembered by many as a founder of the Electrical Trades' Commercial Travellers' Association, being chairman of that organisation in 1926/27, and also a trustee.

Mr G. Clarke, O.B.E., O.ST.J., J.P., formerly chairman and managing director of the Bryan Donkin Co., Ltd., died on 11 Mar.

Mr F. R. Ward, A.M.I.E.E., district manager, Stoke-on-Trent (South) district, Midlands Electricity Board, died on 15 Feb. Earlier he had been manager of the Newcastle (Staffs) district.

Mr C. H. Wilson, M.I.E.E., formerly chief electrical and mechanical engineer, Jodhpur State, died on 8 Mar., aged 71.

Mr D. Hamilton, a director of Crow, Hamilton Ltd., engineers, of Glasgow, died on 5 Mar., aged 65.

Mr H. G. Churchman, managing director of the Colchester firm of motor, radio and electrical wholesalers of that name, died on 9 Mar., aged 56.

Mr E. R. Elliston, co-founder of Elliston, Evans and Jackson Ltd., died on 13 Mar., aged 72.

NEW LITERATURE

Radio and Television Reference Book

Edited by E. Molloy

THE object of this volume is to bring within one comprehensive reference book a complete survey of modern techniques in the design, construction and operation of radio and television systems. The initial section which deals with formulæ and calculations is particularly good, being well illustrated by worked examples. This is followed by a section on optics and electron optics which provides the fundamental basis for an understanding of cathode ray tube and valve operation. The chapters on studios and studio equipment while of general interest, may possibly be regarded as having a direct appeal only to a small proportion of radio enthusiasts. These people will, however, find compensation in the sections which are devoted to broadcasting transmitters, communications transmitters, v.h.f. transmitter receiver equipment, amateur radio equipment, television transmitters, commercial v.h.f. links, and transmitting aerials.

Domestic entertainment is catered for by sections on broadcasting receivers, television receiver design, aerials, interference, and allied subjects, while the high fidelity enthusiasts will find much to interest them in the chapters on magnetic and disc recording, loudspeakers, sound reproduction and distribution, and gramophone mechanisms. In addition to the foregoing the subjects of industrial television, radio navigation and radar, together with the application of the latter to the aeronautical field, are covered briefly. Published by Newnes, 1,670 pages, 7½ in. by 4½ in. Price 70s.

Power—Today and Tomorrow

by E. Sherwood Taylor

TO the student of technological progress, nothing can be more significant than the availability and exploitation of physical power in its various forms. In this book the author provides a survey, for the layman, of the various power sources and their application and use in the modern world. As a secondary power medium, electricity, and its utilisation comes in for short shrift, although the coal, solid fuel, gas and by-product industries are dealt with at considerable length. Nevertheless, within its stated ambit, the information given is reasonable and accurate. Purists might object to some of the author's analogies, and might also be inclined to dispute some of the figures on the relative merits of heating with differing fuels, but to the curious and intelligent reader, whose life is not bound up with fuel technology, the book will be both stimulating and informative. Published by Frederick Muller Ltd., Earls Court Gardens, S.W.5, 102 pages, 7½ in. by 5 in. Price 15s.

Wireless and Electrical Trader Year Book, 1955

PREVIOUS editions of this bright publication have proved invaluable to radio and television engineers in particular, and with all the information completely revised, this 1955 volume will find a ready place on the reference shelves. It again includes condensed specifications of current commercial radio and television receivers, legal and licensing information, and a directory of trade associations. For the trader there is a classified buyers' guide and alphabetical lists of firms and trade names. A new feature gives both alphabetical and territorial lists of radio and electrical wholesalers. With the various sections printed on distinctively coloured paper, reference is a simple matter in this extremely useful year book. Published by Trader Publishing Co., 304 pages, 8¼ in by 5½ in. Price 12s. 6d.

Direct and Alternating Currents, Theory and Machinery

by E. A. Leow and F. R. Bergseth

SINCE 1946 when the third edition of this textbook appeared, there have been many changes and of these undoubtedly the advance in popularity of the m.k.s. system has been the most radical. In this edition the new system has been included and the text revised.

The early chapters on magnetism, electromagnetism and magnetic and dielectric circuits have been extensively revised due to the use of the m.k.s. system, which necessitates a new approach. Apart from this, the book follows a fairly conventional path discussion in turn, basic theory, then more advanced technology, instruments and machines. Power distribution is dealt with in one of the final chapters, circuit calculations and derivations for inductance and capacitance formulæ being quoted. The book winds up with a short discussion of basic electronics and mercury-arc rectifiers, and includes a short description of an ignitron.

Suitable for engineering students proceeding to a degree, the book commences at approximately intermediate standard, with use of simple calculus. Throughout the text is clear and is liberally supported with diagrams and photographs of equipment. Published by McGraw-Hill Publishing Co., Ltd., 95 Farringdon St, London, E.C.4, 637 pages, 9 in. by 6 in. Price 60s.

Power System Transients

Ed. by E. Openshaw Taylor, B.SC., A.C.G.I., F.I.C., M.I.E.E.

THIS symposium brings together in convenient form the latest information on the various aspects of the subject and is mainly aimed at the practicing engineer in supply industry or transformer and switchgear manufacture. However, students intending to specialise in electrical machinery design, power generation or transmission should also find it useful.

R. H. Golde contributed to the opening chapter on causes of transients which introduces lightning effects and the conditions to be expected with faults and resonance. The effects of these phenomena on plants such as transformers, and generators and the steps taken in design of equipment to withstand stresses imposed are discussed in a section contributed by R. W. Flux. Methods of protecting systems against transient voltages, by employing gauge arrestors and earth wires precedes M. G. Say's contribution on the measurement and calculation of the phenomena. A chapter on impulse testing of power transformers, the why's and wherefore's, contributed by D. H. Smith gives details of apparatus and oscillograms of results. Published by George Newnes Ltd., 176 pages, 8½ in. by 5½ in. Price 21s.

Practical Television Circuits

by F. J. Camm

IT is to the amateur television enthusiast that this handy little book is addressed and as a companion to the author's *Practical Wireless Circuits* it merits space on the home constructor's book shelf. Moreover, for its miniature 3 in. television set and details of the construction of test apparatus and auxiliary equipment it has a definite additional appeal to the service engineer. Television receivers range from a model, based on the ex-Government Indicator 62 unit, claimed to be built for as little as £9 to a combined television and sound broadcast receiver, and includes the "Argus" which, for its cost of £20 or so, should appeal to the beginner. Supplementing this useful selection are chapters giving constructional details of television test and auxiliary gear. They include preamplifiers, spot wobblers and black spotter, e.h.t. generators and a variety of pattern generators, among which are seen bar and telesquare generators. The book concludes with details of the "Lynx" a 12 in. receiver, and the "Super-Visor" set with a 16 in. cathode ray tube. Published by Newnes, 288 pages, 7½ in. by 4½ in. Price 15s.

BOOKS RECEIVED

How to read workshop drawings. A practical guide to ready understanding of the working drawings used in engineering and allied industries. New edition revised to bring it into line with latest practice. Published by Percival Marshall and Co., Ltd., 19/20 Noel St, W.1, 63 pages, 7½ in. by 5 in. Price 3s. 6d.

Practical Armature Winding. A survey of the methods of winding small armatures with particular emphasis on the practical aspect. Published by Percival Marshall and Co., Ltd., 100 pages, 7½ in. by 5 in. Price 3s. 6d.

PROBLEMS AND PRACTICE

In Engineering

Overheated Motor

I DOUBT whether "Torque's" explanation is correct in his contribution to your issue dated 10 Feb. A motor cooling fan usually throws the air reasonably uniformly towards the cylindrical face of the endshield and it does not make much difference to which side the outer pipe is fitted.

I am inclined to believe that the fan has shaped blades that are designed to work more effectively in one direction of rotation than the other, or, to put it another way, more effectively than straight radial blades which work equally well for both directions of rotation, and the new direction is the one the designer intended. I suggest if "Torque" retained the new direction of rotation and could change over the outlet pipe to the opposite side of the endshield he would find no worsening in a machine's performance.—*G. H. S. P.*

Starting Trouble

A NEW 120 h.p., 3-phase, 380 V boiler feed water pump had been installed and the time had arrived to test it out. This pump was No. 3, No. 1 being a steam driven auxiliary and No. 2 an electric "old faithful," having given 20 years of service and still fit for use. As only one pump is required to feed the four boilers it was decided to use the existing feeder to No. 2 for No. 3 also, power being tapped through h.r.c. fuses. Apart from getting the new pump started and under load we wished to make sure that the circuit-breaker would not trip out with the extra load. As a precaution the steam auxiliary was warmed up and left running ready to take over in the event of trouble.

Everything being in order the auto-transformer switch was pushed over to start position, when the motor picked up speed. On switching over to run, the switch tripped, but No. 2 kept on pumping showing we still had power. A quick check up revealed nothing amiss so we tried again but with the same result. Suspecting an open circuit in the no-volt coil, the switch was opened and examined but was found in order.

Before attempting to start again the switch cover was removed and the mechanical interlocks examined for stiffness and, as they appeared dry, the pivots were oiled and the handle used vigorously to free the mechanism. Restoring power, we again attempted to get going but now matters were worse because the motor was labouring in the start position and on attempting to switch to run the main breaker tripped. When the steam auxiliary had taken over the load, we again tried with No. 2 stopped but with the same result.

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Reviewing the situation it was noticed that the boiler-house foreman had taken up his stand at the release pressure valve. On enquiring he admitted that he was holding the pump pressure to 30 atmospheres by opening the release valve, protesting that 40 atmospheres was too much for the pump. This explained why the motor was labouring on starting and taking such a big load on attempting to change over to run.

With this matter cleaned up it was obvious now that the difficulty in changing over from start to run lay in the mechanical interlocks. Trying again, but this time not switching over too smartly, the motor picked up and was under load in a short time.

Having met this trouble twice already over a number of years, I feel that, picturing in one's mind arcing and spitting contacts, it goes against the grain to deliberately restrain from making a quick motion between start and run. Manufacturers have had to pack too much into a small space with no-volt coils, overload releases and interlocks to prevent wrong switching. The modern tendency of placing protection in one unit away from the motor with a simple control switch at the motor certainly seems a step in the right direction.—*C. B.*

Hot Starter

AN interesting experience which I had recently concerned a new 5 h.p., 400 V, 3-phase motor with star-delta starter. This machine was installed by an electrician on a Saturday morning, when the factory in question was shut down, and left in good running order.

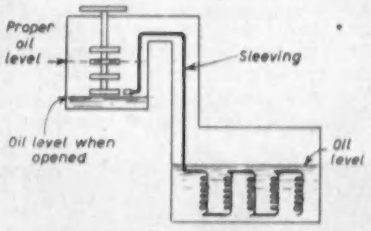
At 8.30 a.m. on the following Monday, a call was received that the starter handle kept dropping out. The electrician who did the work was sent round and reported that the overload was incorrectly set at a low value. This was connected and the machine left running.

At 10 a.m. the same fault was reported again and I decided that a personal call was indicated. On arrival I found the starter handle held in by the time-honoured piece of string, and noted that the starter had been installed immediately over a gas heater, which showed a possible cause of the trouble.

Subsequent tests showed that the heat from the heater was operating the thermal overload release of the starter, and after the starter was moved no further trouble was experienced. One cannot help wondering if, had the works been operating on the morning in question, and the heating system working, the possibility of such a thing happening could have conveyed itself to the electrician.—*R. Welling.*

Oil Moves House

WHEN called in to a 60 h.p., slip ring motor which refused to start, I found that the oil in the starter box instead of being 13½ in. deep was only 2 in., and as can be imagined the contacts were badly burned. There was no sign of oil on the floor and (see sketch) no way of it leaking into the resistance box and yet in there it was. There was exactly that much extra in the resistance



Layout of starter contacts housing and enclosure for starter resistors, showing how oil could have transferred from one to the other by capillary action

box to bring that in the starter up to the correct level.

The leads between the starter and resistances were in sleeving and as both ends of the sleeving were immersed in the oil, it must have moved from one box to the other by capillary action round the sleeving. The cure, if this is what really happened, was to cut back the sleeving above the oil. Perhaps some reader has another explanation or has encountered a similar experience.—*N. S.*

Ovality in Commutators

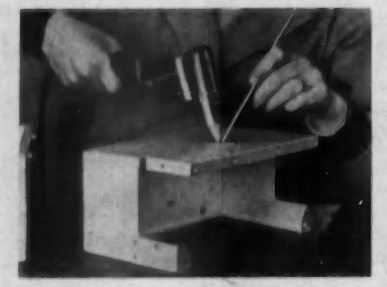
IT is not uncommon for commutators to wear oval and the cause is that the armature shaft is not rotating quite truly. This may be due to excessive play in the bearings or a bent armature shaft. Usually the fault is at the bearings. Ovality cannot be cured by stoning or sanding even if the bearings are first adjusted as the error is merely reproduced. If the armature rotates true for either method of cleaning to be effective, the block or stone must be rigidly fixed to the machine carcase.—*W. E. Warner.*

Equipment for Industry

Aluminium Soldering Made Easy

ONE of the difficulties with aluminium soldering is that by the time the workpiece is up to soldering heat, the prepared surface has oxidised to such an extent that tinning becomes almost impossible. A promising method of overcoming this difficulty is to shorten the time interval between surface preparation, usually scratch-brushing, and tinning and the BELARK TOOL AND STAMPING CO. LTD., have employed this principle in an ingenious manner.

In their new soldering tool, cleaning of the surfaces is carried out by a vibrating steel-wire brush which is located in the centre of the solder bit. To commence soldering, the bit is held vertically to the surface until a pool of molten solder appears around it. The vibrating brush is then brought into action by pressing a trigger and, as the tool is moved over the surface, tinning action takes place. Soldered joints may then be made in the usual way.



With this tool aluminum soldering becomes an easy task

To ensure a long trouble-free life for the tool and to prevent corrosion, all vital parts are made of stainless steel and the copper bit has a special coating of nickel and hard chrome. Marketed by BRITISH CENTRAL ELECTRIC CO., LTD., 6/8 Rosebury Ave, London, E.C.1, the tool is priced at £14, 14s. 0d., and is suitable for use on a.c. mains only, either 110 V or 200-250 V.

Liquid Air on Tap

NEWS has been received of a gas refrigerating machine which provides a convenient means of producing liquid air. Manufactured by PHILIPS ELECTRICAL LTD., Century Hse, Shaftesbury Ave, W.C.2, this equipment comprises three main components which are mounted on a common bedplate and driven by a 10 h.p. squirrel-cage motor, through a flexible uni-directional clutch. Temperatures as low as minus 200° C are said to be obtained quickly and simply and the plant is said to have distinct advantages over more orthodox compression refrigerators which, ordinarily, are only used to produce temperatures of the order of −60 to −80° C. In addition, the new machine is simpler in construction than the "cascade" type usually employed and is said to compare favourably in efficiency with conventional compression types.

The process commences in a liquefier which has a built-in air drier. Provision is made for carbon dioxide removal, and a defroster is also fitted. With an ambient temperature of 20° C, the equipment is said to be capable of producing 5 litres of liquid air/hour and continuous operation for 16 hours is possible in air having a relative humidity of 50%.

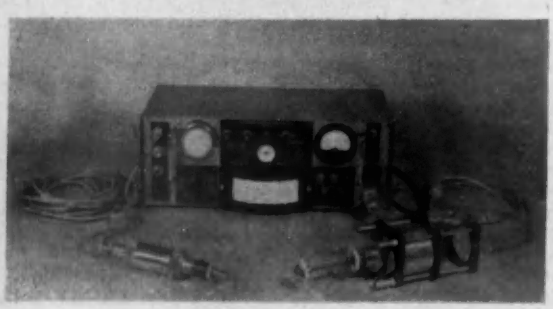
A particular feature of this installation is the short time of running before the low temperature is reached. By virtue of this, it is said to be possible to produce liquid air within 15 minutes of switching on. Due to its performance the machine is finding ready application for local production of liquid air at laboratories, hospitals and other establishments. The manufacturers expect, soon, to be able to offer the machine for deep refrigeration of cooling boxes, as well as for liquefaction of such gases as nitrogen, argon, oxygen and methane.

Balancing Large Rotors

A NEW portable electronic dynamic balancing equipment has been introduced by BRITISH THOMSON-HOUSTON CO., LTD., Rugby. This equipment, known as the "Rotabalance" has been specially developed for use with the larger sizes of high-speed turbo-alternators, where it is necessary for final balance to be carried out at 3,000 r.p.m. It is also suitable for investigating vibration on installed machinery with a view to correction.

The equipment comprises a measuring amplifier, dynamometer, a reference generator and the necessary pick-up units. Vibrations as small as 0·05 thousandths of an inch are said to be detected and for vibration velocities this figure is 0·005 in./sec. In addition the relative phase is said to be determined with an accuracy of ±2%.

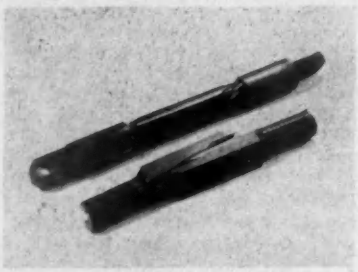
At Hams Hall "A" power station a 51·5 MW twin cylinder turbine was recently rebladed on site. On the initial run, following overhaul, a transverse vibration of 0·009 in. double amplitude was shown. By means of the "Rotabalance" this out-of-balance was reduced until the vibration amplitude was 0·0025 in. Balancing was completed in six hours.



Large turbo-alternator rotors are balanced with this equipment

Tests on "Permali"

DENSIFIED laminates produced by PERMALI LTD., Gloucester, find wide application in the electrical industry due to their good electrical and mechanical properties; their use in transformers and switchgear being particularly well known. To demonstrate the strength of their products, the firm recently subjected two typical specimens to a breaking test, and both are said to have withstood loads considerably above the design figure.



Both the above specimens failed after application of loads in excess of the design figure

In the first case, using a round bar of "Permali" 3 in. diameter by 23 in. long, a force of 37 tons was needed to effect breakage, equivalent to 5·23 tons/sq in. The second specimen yielded with a load of 34 tons. In both cases, fibres were laminated in a lengthwise direction.

Portable l.v. Power

FOR use with portable tools or in applications where a low-voltage power source of up to 5 kVA is required, PARTRIDGE TRANSFORMERS LTD., Roebuck Rd, Tolworth, Surrey, are manufacturing a range of small transformers. Their construction follows the usual pattern of a B.S. rated air-cooled transformer with bakelite terminal board mounted on top, all housed within a sheet steel case. Connections from both h.v. and l.v. are brought out to fuses and the l.v. centre tap is earthed through a link.

Falk's New "Rolac" Ceiling Switch

LARGER version of the "Rolac" ceiling switch is now available from FALK STADELMANN AND CO., LTD., 91 Farringdon Rd, E.C.1. The new size is for 2 in. centre fixing and now affords ample wiring space under the switch box with knock-outs opening into the switch interior. The proved rolling action of the smaller version is incorporated in this model. Other features of importance are the sensibly sized terminals with well-fitting grub screws directly attached to silver faced contacts. Brass inserts in the base ensure maximum security of the cover-base fixing screws whilst ample mouldings around screw holes ensure that the base and cover will not fracture on maximum stress. A floating solid bar contact gives maximum heat dissipation. This provides the shortest possible path through the switch which has a patented two-way action.

Falk's new "Rolac" 2 in centre ceiling switch has more wiring space

BNE Water-Heaters Reduced

PRICE reductions on the 1½ gallon and 3 gallon sizes of their popular non-pressure type electric water heaters are announced by BRITISH NATIONAL ELECTRICS LTD., Charlton, S.E.7. They are now offered at list prices of £10. 10s. (P.T. £4. 1s. 11d.) and £12. 10s. (P.T. £4. 17s. 6d.) respectively, these list price reductions amounting to £1. 11s. 6d. for the 1½ gallon and £1. 8s. 3d. for the 3 gallon.

These heaters are most attractively finished in a glossy white stove enamel by a special process to resist corrosion and ensure hard wearing lasting attractiveness. External fittings are chromium plated.

2-Gang Flush M.E.M. Socket

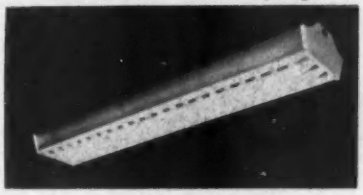
DUE on the home market in July is a new 2-gang flush socket-outlet in brown or ivory to match existing units in the MEM range of flush socket-outlets to B.S. 1363.

MIDLAND ELECTRIC MANUFACTURING CO. LTD., Reddings Lane, Tyseley, Birmingham 11, say that all current carrying parts are moulded on porcelain which is definitely non-tracking. Live contacts are shutter-locked and all inter-connections are included. Generous sized terminals are provided which will accommodate 3-7/·029 cables. Wood and steel boxes are available.

Eterna Louvred Fitting

LATEST introduction by ENSEL ELECTRIC CO., LTD., 215-219 Upper St, N.1, is the "Eterna" twin 5 ft, 80 W louvred fitting with luminating glass side. This new twin fitting is especially designed for store, showroom and office lighting and incorporates high-grade h.p.f. control gear. Provision is made for chain or conduit suspension. Finished in high-gloss white stove enamel and available also as a 4 ft, 40 W model the "Eterna" twin fitting, cat. No. LF802. is claimed by the makers to be the most reasonably priced fitting of its type yet available.

The new Ensel twin-louvred fitting



1955 Coldrator Range

DETAILS have been released of the 1955 range of Coldrator domestic refrigerators by the INTERNATIONAL REFRIGERATOR CO. LTD., Fletton, Peterborough.

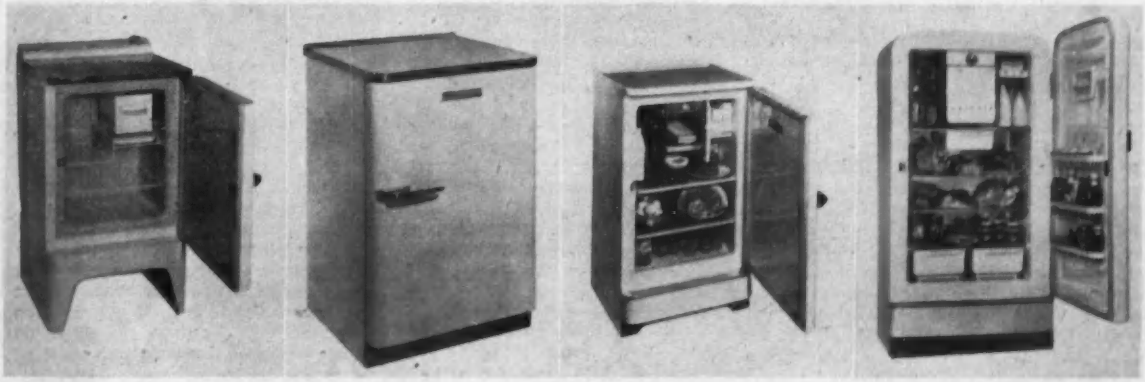
Model AT18 is an absorption type 1½ cu ft table top model, constructed of sheet steel and finished in white with two coats stove enamel. It has a vitreous enamelled table top work surface with a raised section at the back which houses the thermostat control. The pastel blue plastic inner liner is made of rigid p.v.c., whilst steel wire shelves finished in stain and abrasion resistant white enamel provide a total area of 3 sq ft. Included in the list price of 49 guineas, tax paid, are a chiller dish and 18 cube aluminium ice tray.

For the Electrical Trade

Model CT33, a 3·3 cu ft capacity model, is operated by a new design compressor type hermetic unit which features a wire mesh condenser. It has a white finish with one-piece moulded table top. Door is mounted on nylon hinges with trigger operated latch. The inner liner is finished in acid resistant white porcelain enamel, whilst stainless steel freezer has plastic door and 20 cube aluminium ice tray with plastic separator. Three shelves totalling 6·1 sq ft are finished in ice blue enamel. Model CT45, a popular 4½ cu ft model, has the "Buttador" feature which, using a 4 W heater keeps ½ lb butter at the right temperature. This model is listed at 94 guineas, tax paid.

This "Buttador" is incorporated in model CS71, a de luxe 7·1 cu ft model. Special features include a large stainless steel freezer with plastic door, two ice trays, a large chiller dish and cover, two salad drawers on easy glide rollers, auto cold control with "defrost" and "off." Three ice blue enamel wire shelves and a plate glass shelf give a total of 13 sq ft, whilst three shelves are fitted on the inside of the refrigerator door. Price of this unit is 129 guineas, tax paid.

From left to right: The Coldrator AT18, the CT45, the CT33 and the de Luxe CS71



NEWS OF THE WEEK

Speed-up in Monopolies Investigations

Commission to clear eleven subjects by the end of this year

AT the beginning of the present year, there were 11 subjects under consideration by the Monopolies and Restrictive Practices Committee. The Commission hopes to have reported on most of them by the end of the year. This forecast, which implies a marked increase in the speed of working by the Commission, is made in the report by the Board of Trade on the working of the Monopolies and Restrictive Practices Acts during 1954. It is pointed out that the 1953 amending Act has permitted investigations and reports to be made by groups of not less than five members. By the end of 1954, there were eight groups working of eight to ten members.

Subjects of particular electrical interest before the Commission at the end of 1954 were the supply and exports of certain electrical and allied machinery and plant (referred 4th April, 1952), and the supply of electronic valves and cathode ray tubes (referred 4th December, 1954). In addition, there is an investigation into the general effect of the public interest of certain discriminating practices (referred 17th December, 1952). The dates of the "references" show how procedure will have been speeded up if the Commission does indeed report on "most" of the matters under investigation by January next.

The report notes action taken following the publication of the various reports of the Committee. In the main, this has been covered at the time in our "Questions in Parliament" section. It is worth noting, however, that there is a record of examination by the Ministry of Supply of an increase in the price of lamps, announced at the end of 1953, as a result of which the price increases were adjudged "not unreasonable."

Subjects of suggestions and requests for enquiries which reached the Board of Trade during 1954 included batteries (discriminatory arrangements); electric street lighting equipment (common or minimum prices) and electrical equipment for motor vehicles (monopoly).

New Wage Rates for Engineering Workers

AN increase in pay for adult male engineering workers, with effect from 14 Mar., has been agreed between the Engineering Employers' Federation and the Confederation of Shipbuilding and Engineering Unions. For skilled men the rise is 11s. a week, for unskilled 8s., and for intermediate grades of semi-skilled, 9s. 6d. The new basic rates are thus £7. 15s. 10d. a week for skilled men, and £6. 12s. 10d. for unskilled. It has also been agreed to amend the industry's holiday agreement so that men with at least a year's service with an employer will be entitled to two weeks' paid holiday in addition to the six statutory holidays (previously holiday payment was for two weeks only).

Consent to new Colston Shares

TREASURY consent has been given to the issue of £500,000 in shares of £1 each by the newly formed company, Charles Colston Ltd. Readers will remember the announcement of the formation of the company by Sir Charles Colston, former managing director of Hoover Ltd.

Sir Charles said that since the first announcement of the new company, which will develop new household appliances, he has been "inundated with offers of financial backing." His address is given as A13 Albany, Piccadilly, W.1 (Regent 4369).

LORD CITRINE SAYS OVERSEAS BUYERS MORE CRITICAL

IN pointing out the importance of the A.S.E.E. Exhibition to the industry's export trade, Lord Citrine, at the official opening last Tuesday, said that overseas buyers were becoming more choosey, particularly over price and delivery. But, he went on, they could be sure that the quality of British goods and appliances remained unsurpassed. The expansion in the home market was reflected in the growth of electricity supply, where the latest development was the decision to embark on a vast programme of nuclear power stations, resulting surprisingly in demands from people in various parts of the country, to establish these power stations in their own localities.

Following the opening, Mr Byran Donkin proposed a vote of thanks to Lord Citrine and also presented awards to the contest prize winners. These were, in the industrial section, The Record Electrical Co., Ltd., for their graphic recorder with clip-on transformer, and, in the domestic section, Ferranti Ltd., for their "Fridge-Heater."

No ill-will over Scots/B.E.A. "Divorce Proceedings"

SUBJECT of speeches at the annual dinner at the I.E.E.'s Scottish centre recently inevitably concerned the amalgamation of the two southern Electricity Boards. The toast of the Institution was proposed by Mr James Stuart, Secretary of State for Scotland, who will assume responsibility for generation and distribution in the area on 1 Apr. Any fears that the B.E.A. bore ill-will for the "divorce proceedings" were dispelled by Mr J. Eccles, who, in his reply, assured the new Board of the utmost co-operation. Mr Eccles also appealed for more encouragement of the study of science in schools, and a more comprehensive curriculum in technical colleges.

Belgian Conference Discusses Atomic Energy

ON the occasion of the Liège Internationale Fair, the Belgian Society of Electrical Engineers of L'Institut Electrotechnique Montefiore (A.I.M.) is organising a two-day conference on industrial applications of atomic energy. Being held on Tuesday and Wednesday, 3rd and 4th May, the opening morning session is to comprise an address by M. J. Rey, Belgian Minister for Economic Affairs together with expositions by M. F. Perrin, French High Commissioner for Atomic Energy and M. Ryckmans, Honorary Governor-General of the Belgian Congo, and Belgian Commissioner for Atomic Energy. Following sessions will hear Mr. Dunworth of A.E.R.E., Harwell, Mr Tammaro, Assistant General Manager for Research and Industrial Development of the U.S.A. Atomic Energy Commission, M. L. d'Epinay, of Brown-Boveri, M. le Prof de Hemptinne, of the University of Louvain with other delegates from Sweden, Holland and Italy.

The fee for the conference, which includes a complete set of papers, is 250 francs. Persons wishing to attend should apply to the Secretariat of the A.I.M., 31 Rue St. Gilles, Liège, Belgium, and forward subscriptions to Compte Chèques Postaux 153.95 of the A.I.M. or to its account 53402 at the Banque de Bruxelles, Siège de Liège.

£15 EASTER EGG

EMPLOYEES of Hoover will be receiving a very pleasant Easter present. Following continued progress in 1954 all adults employed by the company on 1 Sept. last will receive a bonus of £15, with proportionate payments to younger employees. Conditions which have made this "Easter Egg" possible may be found in our report of the company's activities on page 473.

"LLOYDS" IN 1954

OF a total world shipping tonnage of over 9 million tons at the end of 1954, 5·20m tons gross had turbo-electric propulsion and 0·24m tons diesel electric. These statistics are given in the Annual Report for 1954 of Lloyd's Register of Shipping. The turbo-electric total shows a 55,303 ton increase on the year, and that for diesel electric is up by 36,418 tons gross.

Amongst marine developments noted elsewhere in the Report is a further increase in the number of refrigeration installations classed with the Society. The total is now over 900, nearly 50% more than the corresponding figure for 1938, and there are stated to be indications that refrigerated cargo containers will become more generally adopted by ship-owners in the future. Such containers consist of small self-contained refrigeration units which require an independent supply of electricity for operation.

Non-marine activities of the Society included the survey of both the experimental nuclear power stations being built in Great Britain. In this respect, reference is made to advantages obtained from experimental pilot plants covering matters such as liquid metal heat exchangers. Other electrical projects supervised by the Society include work on three Turkish power stations using British, French and German plant, and the examination of water turbines, alternators and circuit-breakers for New Zealand power stations.

New British Showrooms Opened in Durban

NEW and elaborate premises have been opened in Durban, S. Africa, by the British General Electric Co. (Pty) Ltd. The new three-storey building occupies a site of 15,000 sq ft in Gale St. Provision has been made for extensions to six storeys at a later date. The first two storeys comprised a stores building, workshop and trade sales department some three years ago. Offices and showrooms in Field St were first opened 34 years ago but now all offices, showrooms, stores, workshops and trade sales are in the same building.

Special attention was paid to the display of products in the planning of these premises. There is an attractive window display immediately inside the main entrance, a large display window let into the side of the building to catch the eye of passengers in passing vehicles, and a large display area for industrial equipment on the top floor. These are, of course, in addition to the showrooms consisting of a comprehensive display of appliances and equipment on the ground floor. The suite includes a reception area with a general display of household appliances, fans, lighting fittings, a Tudor room, a French room and a kitchen. There is space too for displays of X-ray and electro-medical equipment, not to mention cubicles for feature displays as and when they are required.

EXPORT CREDIT GUARANTEES SCHEME FOR ELECTRICAL EQUIPMENT

MODIFICATIONS to existing Export Credit Guarantee schemes were announced last week by Mr A. R. W. Low, Minister of State, at the Board of Trade. "Whole turnover" and "selected market" short-term insurance is to be expanded to cover engineering products sold on terms of payment up to a maximum of two years credit, provided the mean period of credit for all the business covered does not exceed 12 months. Until recently 6 months was the maximum, although the situation developing had forced an extension to 12 months for certain types of business. The extended cover will not be given for raw materials, spare parts or straight consumer goods. It is intended rather to cover trade in such items as light industrial machinery, electrical equipment and diesel engines, which are reckoned to comprise a new class (for the Guarantee scheme) of "durable" or "quasi-capital" goods. The extended cover will normally be offered for only 20% of an exporter's annual turnover in the past two years, or 20% of the business offered for insurance, whichever is the lower.

In "whole turnover" insurance, all export trade for the subsequent 12 months is insured at set *pro rata* premiums. "Selected market" cover gives similar protection for part of this trade. The spread of risk permits lower premiums to be offered than with insurance based on specific contracts. Previously goods sold on credit much beyond 12 months have been eligible only for this latter, more expensive form of cover under the E.C. Guarantee scheme.

Expansion Plans of J. & P. Company

FOURTH annual apprentice night of Johnson and Phillips took place recently at Woolwich Town Hall. Presentation of prizes was followed by refreshments, dancing and cabaret. In his address, Mr G. Leslie Wates, chairman, spoke of the increasing growth in the company's activities mentioning particularly production of capacitors. He said a substantial expansion plan would be put into operation in the near future. Although completion of the new plant at New Cross was not far off, work was not quick enough for the company. Already much of the new floor space was in use.

The First Half-Century

It may be remembered that a few weeks ago Mr Suter read a paper recommending a system of certificate by examination for wiremen, with a view to the elimination of the unfit. In particular the examination test was questioned and someone wanted to put representatives of the workmen themselves on the board of examiners to certify their own fitness. The Northern section of the National Contractors' Association has hit upon a more excellent way. Members issue to their workmen tickets giving their name, occupation, and some account of their characters and capabilities. These last are indicated in cipher which is frequently changed, and whenever a ticket is issued a notification is sent to the branch secretary. It is said that the workmen like the system, since it makes it easy to obtain employment, and to some extent it protects the employer, since cards are not granted to the hopelessly incompetent, and the less satisfactory workman can be recognised by the cipher description.—*From our issue of the 16 Mar.*, 1905.

General view of British General Electric's new premises in Gale St, Durban. The display window can be seen under the name sign and above the ground floor level. Below right is the main showroom.

Consultative Council is Accused of Excessive Criticism

FINAL meeting of the S.E. Scotland Electricity Consultative Council in Edinburgh last week was notable for some comments on their activities by Sir Norman Duke, chairman of the Area Board. He paid tribute to the Council's work, saying that the Board had often received their support and had frequently been indebted for useful suggestions.

Other points were more doubtful, he said. The council's monthly meetings were public and consequently full publicity had been given to criticisms of the Board, irrespective of their merits. Sir Norman went on to say that the Council appeared to feel it their duty, however much the Board was doing, to keep on pressing for more and so regarded themselves as a spur to be freely applied, however willing the horse. He said he did not agree with that viewpoint although he recognised the reasoning behind it and made no complaint. Sir Norman said it was not always appreciated that the Board was a non-profit-making concern, but in effect a board of trustees concerned with the distribution of electricity in the best interests of consumers.

One of the major concerns of the Council has been rural electrification in the area and Sir Norman appropriately dealt with this subject at length. After a brief history of progress he said that this year capital available enabled the Board to increase the rate of connection and to plan for expenditure of £337,000. As a result of the Council's successful visit to London, that figure had been raised to £402,000, although it would not be practical to spend all that this year.

At the same meeting the Council was told that the Board could not bring the commercial tariff in Falkirk down to the same level as that of Edinburgh. Such a step would be followed by similar applications in other districts. There would probably be some adjustments in the tariffs made in the future and the matter would be referred to the new S. of Scotland Board.

Highfield Papers next week

WINNERS of the first three prizes in the A.S.E.E.'s 1954-55 Highfield Shield competition will deliver their papers at a meeting at London's Lighting Service Bureau, 2 Savoy Hill, W.C.2, next Tuesday (22 Mar.). The three papers will be on "Magnetic Amplifiers" by Mr D. H. Taylor, "Evolution of Fluorescent Lighting Control Circuits" by Mr G. V. McNeil, and "Photometric Curves" by Mr H. G. Batson. Mr Bryan Donkin, A.S.E.E. president, will be in the chair and proceedings will begin at 6.30 p.m.

NEW THORN FACTORIES

THREE new factories for Thorn Electrical Industries are to be built in addition to those now in course of erection at Enfield.

A 60,000 sq ft factory on the Pallion estate near Sunderland has been acquired for the production of radiogram cabinets for the Ferguson Division and will provide employment for about two hundred.

For the television side of Ferguson activities Thorn have acquired an additional factory in Great Cambridge Rd, Enfield, whilst a third factory at Uxbridge, Middx, is being taken over for extended production of special lighting fittings for the subsidiary, George Forrest company.

Calling Old Faradians

AT the annual general meeting of the Faraday House Old Students Association held last week the retiring president, Mr E. L. Gethin, stressed the importance of membership. Although most students who leave the college nowadays join the association, in past years, particularly before and during the war this was not the case. He asked all members present to contact any old students who they knew were not members, so that the membership could be strengthened.

An appropriate display in view of the emphasis on the electric motor at the current Electrical Engineers' Exhibition at Earls Court. It is to be found at the Westminster offices of Brook Motors Ltd.

Industrial Fairs at Karachi and Delhi

EXECUTIVES of Auger and Turner Ltd. leave for Indian and Pakistan tomorrow to make on-the-spot surveys of arrangements for erecting U.K. Pavilions at the trade fairs in New Delhi and Karachi. References have already been made to these two exhibitions in these columns, and interested manufacturers are asked to apply to the organisers as soon as possible. The exhibition at Karachi will take place between 2 Sept. to 2 Oct., and that at New Delhi from 29 Oct. to 15 Dec.

Manufacturers may recall figures for the export of electrical goods last January which show that India is the U.K.'s fourth best customer importing goods to the value of £1,283,766. Pakistan ranks eleventh with imports worth £328,589.

JOINING THE E.T.C.T.A.

A 15% rebate on car insurance, benefits in the event of injury and free legal aid, are some of the advantages offered with membership of the Electrical Trades Commercial Travellers' Association. Founded in 1925, the Association promotes fraternisation of travellers in the industry, and in addition to assisting financially any member in straightened circumstances, also maintains a register of vacancies. An enthusiastic and generous contributor to the funds of the Electrical Industries Benevolent Association, the E.T.C.T.A. also supports the Royal Commercial Travellers' Schools, where orphans of members are admitted. Further details of these and other advantages of membership of the E.T.C.T.A. may be obtained from the hon. secretary, Mr P. E. Pike, 18 Carew Rd, Wallington, Surrey.

Vast Responsibilities of Electrical Engineers

THE increasingly important role to be played in the future by the electrical industry and electrical engineer in the development of nuclear energy was emphasised by Mr S. F. Steward, chairman of the S.W. Electricity Board last Friday. He was proposing the toast of the Institution of Electrical Engineers at the annual dinner of the Institution's Western Centre held in Bristol. He stressed the tremendous responsibility which would rest on the shoulders of professional electrical engineers, but also issued a warning. Mr Steward said the problems of nuclear electricity and widespread electrification must not be allowed to obscure the need to perfect the art of selling electricity and the electrical way of life. There was a danger that efforts would be concentrated on absorbing scientific and production problems and indulging in the complacent philosophy that electricity was so good it would sell itself. The object was not just to build bigger power stations but to sell more and more electricity to more and more people.

Lighting Installation in Process Works

THE process works probably presents the illuminating engineer with one of his most exacting problems. He must provide adequate lighting for the most intricate work as well as suitable lighting for colour proofing and good overall illumination. A recent installation was carried out at the new premises in Clerkenwell of Wace and Co. by Thorn Electrical Industries Ltd.

In the composing room Atlas FTQ 0082 fittings were used to give maximum diffusion without glare or shadow. These opal "Perspex" trough units can be mounted at low levels without being oppressive. Northlight tubes were fitted wherever colour reproduction was involved. A feature of the installation was the construction of a special viewing cabinet housing 15 W 18 in. tubes so that colour transparency subjects could be inspected under similar conditions.

Executive offices and entrance hall were fitted with HTQ 0080 and HTQ 2080 louvred troffer units which provide a high level of lighting and tend to avoid the dark ceiling effect. Electrical contractors in this installation were Wm. Steward and Co., Ltd.

Opal "Perspex" trough units housing Atlas Northlight tubes in the composing room of Wace and Co.'s process works, at Clerkenwell. Only two types of fittings were used in the factory area to simplify maintenance

Hotel Converted into Electricity Offices

HOSKEN'S Hotel in Barn Hill, Stamford, has been bought by the E. Midlands Electricity Board who are planning to convert it into offices. It is proposed to amalgamate the administrative staffs hitherto situated in St. Mary's St, Stamford, and North St, Bourne. Showrooms in both towns will remain open. The hotel is to be taken over on 1 Apr. when Mr D. E. Castley, district manager at Bourne, will move to Stamford.

Doctor says Standardise Plugs in All Hospitals

A SURVEY of electrical fittings in all hospitals in the N. Wales area is to be made. Mr Ifor Lewis, specialist at the Royal Alexandra Hospital at Rhyl has asked for a report from the engineers in all hospitals. He called for the standardisation of electric plugs in hospitals. He said the different types of plugs in use in hospitals could lead not only to annoyance, but to loss of life.

E.A.W.'s 30th Birthday

AS reported in these columns on 21 Oct., the E.A.W. decided that their 30th birthday celebrations would be postponed until Apr. this year because of the illness of their founder-director, Dame Caroline Haslett. The Association's 30th anniversary actually occurred on 12 Nov. In the E.A.W. programme of events for the winter and spring we note that the annual conference opens in London on 27 Apr. at the Connaught Rooms. On the previous evening Sir Lawrence Bragg will deliver an address on Thirty Years of Electrical Progress at the Royal Institution.

Electrical Engineers' Exhibition

IT should be pointed out that, on page 406 of the 10 Mar. issue, the description of equipment shown at the above exhibition by Porter Electrical Products Ltd. should have referred to the "Dyrod" earthing electrode as a rod of D section, and not a plate as stated.

OFFICIAL PUBLICATIONS

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. Report for 1953-54. H.M.S.O. 9s. (See p. 444.)

MONOPOLIES AND RESTRICTIVE PRACTICES ACTS. Annual of Board of Trade. H.M.S.O. 9d. (See page 468.)

BRITISH STANDARDS: B.S.2579/1955; Solid drawn copper alloy tubes and copper alloy screwed ferrules. B.S. 2572/1955; Phenolic Laminated Sheet. B.S.2569/1955; Spray Metal Coatings; Parts 1 and 2.

Hardware Trades Fair for 1956

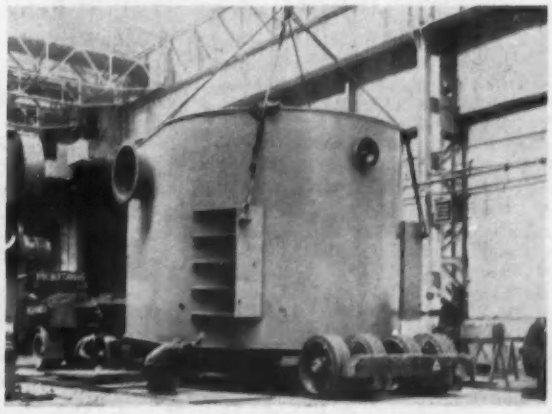
THE Hardware Trades Fair held for the first time last month is to be repeated next year. It proved so popular that within a fortnight of its opening, 75% of stand space for a 1956 show had been booked. The decision to hold another Fair thus became a formality, and the dates for 1956 were fixed for 20 to 24 Feb. Both Horticultural Halls will be occupied next time and the reservation of a New Exhibitors' Section will ensure that space is available for newcomers.

3,000 Firms benefit from New S.W. Tariff

REDUCTION in industrial tariffs, calculated to save large consumers about £40,000 a year were announced by the S.W. Electricity Board last week. The change follows amendments to the bulk supply tariff made by the B.E.A. some weeks ago. For consumers on the demand tariff and the alternative demand tariff for supplies to industrial premises, the new rate of adjustment for coal price will be ·00065d. per unit for each 1d. cost above or below 60s. per ton in respect of high voltage supplies and ·0007d. per unit in respect of low voltage supplies. These figures replace present rates of ·0007d. and ·00075d. per unit respectively. The reduction will also apply to contract rates based on a coal cost of 60s. a ton. It has the effect of absorbing coal costs of about 1s. 6d. a ton without passing them on to consumers. About 3,200 firms in the Board's Area are likely to benefit.

Highland Hoteliers Complain

HOTELIERS in the N. of Scotland are dissatisfied with the Board's tariffs. At a meeting of the Grantown Hotels Association, their chairman said they were charged on the assumption that hotels used the same number of rooms in the winter as in the summer, which was entirely erroneous. The Association is protesting to the Board and asking for a meeting to discuss means of lowering charges during the "off-season."



Part of a Metrovick steam condenser of 80,000 sq ft cooling surface for Castle Donnington power station of the B.E.A. being loaded into a special trailer at the Germiston Works (Glasgow) of Metropolitan-Vickers. Five of these condenser units have been ordered from the company

SEC London Staff Return to Victoria

LONDON office of the State Electricity Commission of Victoria, for some time at 25 Charles II St, S.W.1, has this week closed down. The senior members of the staff are returning to Australia. The office was originally opened as a buying mission six years ago.

Hot Tips for Racegoers

AN electric heating system is to be installed at various racecourses on the outskirts of Paris, we hear. At Auteuil, electric radiators giving out infra-red rays heat the front five rows in the reserved stand as well as the totalisator hall. This method of heating was to be extended to the rest of the stand and to the bar. At a later date the upper gallery of the public stand will also benefit.

NEWS IN BRIEF

Dr Bowers of De Oude Delfit, designer at the Odelca Camera for Fluorography, will address the Society of X-ray Technologists at the I.E.E. on 15 Apr. Meeting is being arranged by Institute of Physics Non-Destructive Testing Group.

Thirteen electrical teams in the Midlands took part in the annual area competition of the British Electricity Ambulance Centre. Stourport power station won the men's section and Gloucester women's team the ladies' prize.

Johnson and Phillips' Amateur Dramatic Club have formed a Variety Section and made a successful debut with a musical comedy entitled "Isn't it Naughty?"

Glowing tributes have been paid locally to the Yorkshire Board's work in reinforcing the electricity supply in the Wadsworth area. Much of the task was carried out in terrible weather conditions.

The Manx Electric Railway Co. may have to close down unless there is an improvement in traffic returns. Last year's loss of £863 has been increased this year to £2,005. Chairman states that unless there is an increase this summer they cannot continue to provide a transport service on the island out of their own resources.

In accordance with their policy of holding a number of meetings in industrial centres, the newly-formed Society of Non-Destructive Examination will hold a summer meeting in Manchester on 15 July. Mr L. E. Benson of Metrovick will speak on Non-destructive Testing applied to Electrical Engineering Production. Society's H.Q. is at Duncan Hse, Dolphin Sq, London, S.W.1.

The B.B.C.'s first new VHF transmitting station using frequency modulation will come into service at Wrotham, Kent, on 2 May.

Course of eight lectures on The Science of Colour applied to Colour TV begins at Imperial College, S. Kensington, S.W.7, on 26 Apr. Lecturer will be Prof W. D. Wright.

The North-Western Management Conference organised by the British Institute of Management takes place at Southport this weekend. It opens tomorrow.

QUESTIONS IN PARLIAMENT

Hydro Power in N. Rhodesia

ACQUISITION of land in N. Rhodesia for hydro-electric development was the subject of a question by Mr A. J. Irvine recently. He asked whether money received from individuals and companies granted rights for such development in the Native Trust Lands and the N. Rhodesia (N.T.L.) Amendment No. 2 Order of last year, would be made payable to the original occupier, owner, the native authority or the Native Trust Land Fund. Mr Lennox-Boyd explained that under the N.T.L. Order in Council, the Governor could acquire land for public purposes, and the amendment was simply to make it clear that hydro-electric development was included. If land was acquired compensation had to be paid both to the occupier and to the N.T.L. Fund. The amendment was of general application and it was not considered necessary to consult the Native Authority. The Authority had to be consulted before land was acquired.

Shillings for the Meter

REPLYING to complaints of alleged shortages of shillings, Mr R. A. Butler said local shortages could be met if application was made to the banks. About 640 million shillings were in circulation at present, and the net issue in 1954 was 51 million. Programme for the current year provided for an output of 50 million shillings.

Nuclear Training

IN view of the projected development of atomic energy Wing Comdr Hulbert asked what steps were being taken to ensure an adequate supply of trained engineers. Mr N. Birch said that engineers from the B.E.A. and a number of industrial firms were training at Harwell, and teams were working with the Authority's experts on the design of nuclear power plants. He added that some universities were holding courses on nuclear engineering.

Soot from Bankside

COMPLAINTS concerning the amount of soot and dirt emitted from Bankside old power station were made last week by Mr G. A. Isaacs. He alleged that the emissions had increased this winter by about 50% and that recording instruments used by Southwark Borough Council showed that 76 tons of dirt were deposited in an area of about one sq mile in one month. Observations also showed concentration of sulphur dioxide in the air as well as deposits of sulphur compounds, he said. The Minister replied, however, that he had no evidence to show that emissions had increased in the last 12 months.

Mr Isaacs asserted that the Borough's figures were official figures, and complained also that the nuisance was suffered in the summer as well as in winter. Mr Duncan Sandys suggested the figures quoted were more general calculations rather than those selective to soot emitted from the power station. Nevertheless, inspectors were to investigate the situation shortly. Mr Isaacs said he would raise the matter again.

Smoke Abatement

THE Minister of Housing and Local Government last week rejected a suggestion that a subsidy of £3,000 p.a. should be paid from Government revenues to the National Smoke Abatement Society. He agreed that the Society did most useful work but it did not follow that a subsidy was called for. Mr P. Noel-Baker suggested a subsidy would be a sound investment in view of the nation's annual loss was about £300 millions a year, but the Minister, whilst sympathetic, said there were so many deserving requests for subsidies.

Purchase Tax Problems

A STATEMENT on the problems of retailers caused each time purchase tax rates were changed was asked for by Mr H. R. Gower. Mr H. Brooke said the problem was carefully examined by an independent committee but no satisfactory solution was discovered. All suggestions made so far had contained some fatal weakness, but any further proposals would always be considered. Mr Brooke said later that when recent reductions in tax had been made, retailers appeared so grateful that they had not complained of the absence of a solution to the problem.

Science Education

THE recommendations of the Burnham Committee on the subject of increased allowances for teachers of advanced work had been accepted by the Government, Sir David Eccles stated. He said he expected them to be fully carried out by local authorities. The proposed increases in pay would greatly improve teachers' prospects. Sir David went on to say the Government was reviewing the whole question of scientists in public service to ensure that the best use was made of them. The F.B.I. had asked all members to refrain from raising salaries in competition with the Burnham proposals, and to review the use they made of science graduates.

Mr G. R. Chetwynd then asked if graduates in industry could give part-time service in science education. The Minister said that was one of the questions the F.B.I. was bringing to the notice of their members. Replying to another question by Mr A. A. H. Marlowe, Sir David said he was not satisfied that boys were staying long enough at secondary schools to avail themselves of further education.

COMPANY ACTIVITIES

NOBODY can say that electrical manufacturing companies are not making the best of the boom. Eriesson Telephones Ltd. is no exception. The full report for 1954 is the first indication of its results. Ericsson does not conform with modern practice by issuing preliminary figures. After placing more to depreciation, trading profit is up from £946,000 to £1,273,000. After payment of tax, the 20% tax free dividend is covered nearly three times.

Sir Harold A. Wernher, the chairman, has built up a position of considerable financial strength. Free reserves now amount to £2,610,000 against an issued capital of £1 million, half of which was a bonus issue last year. Liquid funds have advanced to £1,396,000. Recent announcements made by the Postmaster-General suggest that the company's products will again be in increasing demand this year. The 5s. Ordinary units at 36s. 3d. give a gross return of around 5% including the 16% final tax free dividend in the price.

There is no stopping the Hoover business. Two managing directors have gone by the board, Sir Charles Colston and Mr J. A. Wykes, Sir Charles Colston incidentally seems to have got an all-time peak compensation of £83,575, while Mr Wykes' payout may have been £13,600, according to items in the report. And still the company records show turnover and profits. Despite export market problems, the sterling value of the group's exports was 63% of the total British exports of cleaners and 50% of total of electric washing machines, exclusive of products manufactured overseas. The chairman pays tribute to the early pre-Budget announcement about purchase tax changes, and the July withdrawal of hire purchase restrictions. Profits last year were £4½ millions, which was 49% greater than in 1953 and 187% over 1952. Workers are to get £15 apiece as an "Easter egg" on account of their excellent work last year. This is on top of the normal incentive bonus. Hoover must be a prime example of how the incentive works. For directors and chief executives the company issued a few years ago £40,000 of 1s. "A" shares at par. Owing to their terms of profit sharing, they are now worth over £4 millions and a proportion are now in the hands of the public. They have become quite an embarrassment owing to what appears to be some laxity in the terms of issue.

International Combustion may be very glad that its net cash and other liquid resources at £1.662,000 form such a high proportion of the free reserve of £1,719,000. In his annual statement, the chairman, Mr G. R. T. Taylor, explains a little of the difficulties brought about by the trend towards a considerable increase in the size of steam-raising units. —*From our City Correspondent.*

Barbados Electric Supply Corpn Ltd.

For the year ended 30 June last, the net profit, after taxation, etc., amounts to £16.882, compared with £13,668 a year earlier. The dividend is again 5% tax free. It is proposed that a subsidiary be incorporated on 1 July next to which fixed assets will be transferred. Ordinary capital of this subsidiary will be approximately £675,000.

British Industrial Plastics Ltd.

It has been decided to take advantage of the option to repay the £250,000 Notes on 1 July, Mr K. M. Chance, the chairman, states, with his statement of results for the year ended 30 Sept. last. The group trading profit is £875,414 (*£544,290*), and with a final dividend of 12½%, the total distribution is 20%.

Cambridge Instrument Co. Ltd.

For 1954, the profit amounts to £632,985 (*£535,719*). A final dividend of 2½%, makes a total of 17½% tax free for the year, on capital increase by a one-for-fourteen scrip issue.

Desoutter Brothers (Holdings) Ltd.

Export sales increased by 27% last year; home sales also rose, giving an overall increase of 14½% over the previous year, Mr G. H. Webb, the chairman, reports. The order book remains in a healthy condition and a reasonably satisfactory result for 1955 is anticipated. Orders have been placed for a number of machine tools, both for the Press Tool Set Division and for the Electric and Pneumatic Tools Departments.

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1951	257,220	63,203	29	16	17/-	12/1
1952	381,595	107,800	53	18	16/6	14/-
1953	403,804	127,938	61	20	17/6	14/3
1954	495,721	228,321	113	25	27/-	16/1

Eriesson Telephones Ltd.

Trading profit for 1954 is £1,272,732, compared with £946,574 a year ago. The final dividend is 12% and bonus 4%, making 20% tax free (same) but on doubled capital.

Franco Signs Ltd.

There is a slight reduction in the group trading profit for the year ended 30 Sept. last. The figure is £126,156, compared with £130,831. Dividend is again 10%.

Hoover Ltd.

Claiming 50% of the total value of British exports of electric washing machines and 63% of cleaners, this concern achieved new records both in turnover and profit in 1954. Home sales of electric cleaners increased by 35%, washing machines by 42%, while sales of f.h.p. motors were more than doubled. Sales of polishers are relatively small in the home market, but abroad, business is most successful, particularly in Australia, where polisher sales are often as high as cleaner sales. There is confidence that the steam-or-dry iron will prove to be a winner. In the overseas markets, conditions were not quite so good, although in Australia operations have been very successful, the local factory producing all the Mark II washing machines so that now less than one-third of the total parts are imported from Gt. Britain. In New Zealand a new company has been established, while the South African subsidiary has had a most successful year. In addition, dollar earnings compare favourably with earlier years. Looking to the future, the Research and Development Department is being expanded, and extensions are being made to the High Wycombe and Merthyr Tydfil factories. Production engineers are at present concerned with electronics, aiming to eliminate the fallible human element.

Year to 31 Dec.	£ Trading Profit	£ Net Profit*	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	2,984,238	996,883	95	37½†	52/3	34/3
1951	3,648,252	1,086,178	109	35	39/3	24/9
1952	2,226,171	524,851	52	25	27/9	21/-
1953	3,945,342	1,106,866	106	45	26/10	20/3
1954	5,631,107	2,140,891	193	70	52/-	26/3

*Attributable to parent company.
†Plus 100% capital bonus.

International Combustion (Holdings)

Output of the group was well maintained and the order book is steady up to the present, but the inclination for larger sized steam raising units may have the effect of causing fairly serious fluctuations in the amount of orders in hand in future, Mr G. R. T. Taylor, the chairman, states. While it is felt in certain quarters that the generation of steam by the use of nuclear energy may not be a commercial proposition for some time, we are devoting our attention to the possibility of rapid strides being made in this direction and are taking steps so that we may be in a position to take full advantage of any major development in this respect, he adds.

Year to 30 Sept.	£ Trading Profit	£ Net Profit*	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	1,052,970	369,118	75	20	17/4	14/9
1951	1,366,701	536,059	115	25	24/-	15/9
1952	1,691,846	447,078	44	20†	12/10	9/3
1953	1,640,399	496,109	42	20	15/6	12/1
1954	1,624,924	629,004	59	25	30/-	14/6

*Available for parent company.
†Plus 100% capital bonus.

Midland Electric Manfg Co. Ltd.

The improvement in trading conditions in the latter part of 1953 has been fully maintained, Mr A. Wynn, the chairman, reports. Overseas business has also continued to recover and every effort is being made to promote still further expansion in that direction. The order book position shows cause for considerable satisfaction, and in consequence, production

is continuing at a high level. Additional capacity is being planned by extending manufacturing activities to a new branch factory in course of erection at Redditch.

Year to 31 Dec.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	328,207	129,616	51	15	58/–	52/9
1951	376,841	138,611	57	15	67/–	56/3
1952	477,080	155,811	65	15	60/6	52/3
1953	385,611	145,088	57	15	63/6	56/–
1954	448,738	190,940	40	10*	46/–	31/6

*Plus 100% capital bonus.

In due course this will involve additional financial outlay.

Oriental Telephone and Electric Co. Ltd.

Following the acquisition last Dec. of the telephone undertaking in Singapore and Johore Bahru, the directors propose a capital repayment of 19s. per £1 unit prior to going into voluntary liquidation. Mr E. J. Bunbury, the chairman, states that £1,750,000 "on account" payments have been received and he does not anticipate that when agreement has been reached any part will have to be repaid by the company. It is hoped to hold the annual meeting as usual and to recommend a dividend in respect of 1954. A 4% interim has already been paid.

Taylor Tunnicliff (Electric Industries)

A fairly high level of production was maintained by most of the subsidiaries during the past year, Sir John Kent, chairman, reports. The order books can be considered satisfactory, but he warns that the labour shortage still persists and affects total production.

Year to 31 Dec.	£ Trading Profit	£ Net Profit*	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1950	359,922	136,360	79	20	16/6	13/6
1951	448,178	155,588	95	20	23/–	16/7
1952	418,944	154,233	94	25	19/6	18/3
1953	376,634	146,636	45	12½†	12/4	9/4
1954	428,133	162,809	47	15	12/4	10/7

*Attributable to parent company.
†Plus 100% capital bonus.

Dividend Declared

E. K. Cole Ltd. Interim 7½% (*10%*) but on increased capital.

Sayings OF THE WEEK

"The purpose of research is to liberate man by reducing his labours." . . . D. DE ROUGEMONT, director of European Cultural Centre, at the opening of the Geneva Laboratory.

"It is wrong that there should continue to exist the idea that white-collared, black-coated and clean-handed occupations are more honourable than others." . . . PROF G. H. RAWCLIFFE, at I.E.E. Western Centre annual dinner.

"I feel that the Council is living in a time when very shortly they will be spending millions of pounds taking down overhead lines." . . . MR F. A. EDWARDS, at Malvern U.D.C. meeting.

ELECTRIC SUPPLY NEWS

Blyth

The Minister of Fuel and Power has given his formal consent to the B.E.A.'s proposal to erect a new power station at Blyth, Northumberland, concerning which a public inquiry was recently held. But the Minister has decided that the ash is to be dumped by barges outside the three mile offshore limit—the B.E.A. wanted to remove the ash by sluicing through a pipeline leading across the foreshore near the station. The first section of the station, which is to be erected on the north bank of the River Blyth at Cambois, will have four 120 MW turbo-alternators.

Bolton

The Minister of Fuel and Power has refused an application by the B.E.A. for permission to erect 275 kV transmission lines through open country to the west of Bolton. Among the organisations which objected to the route were Bolton Corporation, and the Lancashire branch of the Council for the Preservation of Rural England. At an inquiry last Nov., it was stated for the B.E.A. that the alternative suggested route for the pylons, to the east of Bolton, would add £71,000 to the cost of the scheme to take the line through Lancashire.

Kent

To improve supply conditions to the Oxted and Lingfield area, the South Eastern Electricity Board propose to erect a 33 kV line from Four Elms to the Crowhurst substation. It is expected that the work will be completed this summer.

Machynlleth

The B.E.A. has received the consent of the Minister of Fuel and Power to the establishment of a new diesel engine power station, to be known as Machynlleth "B" power station, which is to have three 1,200 kW sets and one 268 kW unit.

North Wales

The question of power lines and amenities was again raised at a meeting of the Denbighshire Park Planning Committee—when the Merseyside and North Wales Electricity Board sought permission to erect a transformer and pole near Fairy Glen House, Bettws-y-Coed. One member suggested that if amenities, particularly in the Snowdonia Park area, were to be preserved electric cables should be placed underground. The chairman of the committee, Mr L. P. Burrill, stated that they were anxious to preserve amenities in such spots, but there was no alternative in this case. The county planning officer, Mr A. V. Lewis, said that the immeasurable benefit of electricity in the rural areas, where many were living in primitive conditions, superseded the visual amenities. Because underground cables were too expensive rural areas had to be served by overhead cables. No objection was raised by the committee, provided the pole was erected 15 ft from the highway boundary wall.

Poole

A further extension of Poole power station, involving the installation of another 60 MW turbo-alternator and one boiler in 1960, is being proposed by the B.E.A., Mr C. J. Stockell, the station superintendent, has told the West Hants and Poole District Advisory committee of the Southern Regional Board for Industry. He said the original design of the station was generous with regard to the provision of boiler capacity, and early operating experience indicated that individual boilers were liberally rated, and at present there was an excess of boiler capacity for the four 52·5 MW sets. It had been decided to install a 60 MW turbo-alternator as part of the 1959 programme, and the second 60 MW set and one boiler in 1960. The station was receiving supplies of continental coal, and the stock position was very good. No decision had yet been taken regarding converting the station to dual-firing purposes, he added.

Stornoway

Additional diesel plant installed at Stornoway power station to meet the growing demand in Lewis, has been formally taken over from the manufacturers by the North of Scotland Hydro-Electric Board. Stornoway now has the largest diesel station in Scotland.

Strichen

An electricity supply was switched on to the village of New Leeds at a public ceremony a few days ago, attended by Sir Hugh Mackenzie, deputy chairman of the North of Scotland Hydro Electric Board. It was a further stage in the completion of the £1,000,000 Strichen scheme of the Board, which aims at bringing electricity to 2,400 farms and 2,000 other premises in a 450 sq mile area in Aberdeenshire and Banffshire. The scheme, which has been in progress nearly two years, should be completed by June 1956.

LIGHTING SCHEMES

Banstead. The Council has approved street lighting schemes for Lower Kingswood, Tadworth, Nork and Banstead, at an estimated cost of £37,130.

Bexhill. The sum of £4,955 is included in the 1955-56 estimates for additional street lighting.

Birkenhead. The T.C. is to spend £30,000 on improving street lighting in the next financial year.

Brigg. The Council has approved improved street lighting schemes to cost £12,550.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

19 Mar.—Worsley U.D.C. Class A concrete columns, lamps and lanterns for 140 W sodium lighting. — See 3 Mar. issue.

21 Mar.—Manchester T.C. Installation in old people's dwellings at Middleton.—Advertised in 3 Mar. issue.

21 Mar.—Wigan T.C. Street lighting equipment for various schemes.—See 3 Mar. issue.

22 Mar.—Belfast. Installation of lift at Min. of Commerce Laboratory, Vener St.—See 10 Mar. issue.

22 Mar.—Shrewsbury T.C. Electrically-operated sewage pumps or compressed air ejectors.—See 10 Mar. issue.

23 Mar.—Co. Antrim. Installation in Finaghy primary school.—See 10 Mar. issue.

23 Mar.—Clutton (Bristol) R.D.C. Installation in 50 houses at Timsbury.—See 3 Mar. issue.

25 Mar.—Manchester T.C. Various types of service cables and telephone cable at Haweswater Works, Westmorland.—Advertised in 24 Feb. issue.

25 Mar.—Roxburghshire. Electrical work in houses at Denholm.—See 10 Mar. issue.

28 Mar—Stockton-on-Tees T.C. Electrical work in 25 houses and three blocks of three-storey flats at Newtown Estate. T. C. Hartley, borough architect, 28 The Square, Stockton. Deposit £1. 1s.

30 Mar.—Warrington T.C. Rewiring at Central Police Station in Arpley St. Borough Surveyor, Town Hall.—See 10 Mar. issue.

30 Mar.—Yeovil T.C. Steel columns with lanterns, lamps, etc., for mercury vapour and tungsten street lighting scheme 1955-56. Advertised in 10 Mar. issue.

31 Mar.—Belfast T.C. Central evaporating plant.—Advertised in 27 Jan. issue.

31 Mar.—Carlisle T.C. Installation in crematorium.—See 10 Mar. issue.

31 Mar.—Durham C.C. Supply of heavy duty cooking equipment to central kitchens, school canteens, etc., during year commencing 1 Apr. 1955. Director of Education, School Meals Service, 58 Hallgarth St, Durham.

31 Mar.—Inverness. Electrical work in erection of primary school at Hilton.—See 3 Mar. issue.

31 Mar.—Saltburn and Marske-by-the-Sea U.D.C. Supply and erection of 12 street lighting units. R. Stroughair, engineer and surveyor, Council Offices, Saltburn-by-the-Sea. Deposit £2. 2s.

2 Apr.—Cheadle and Gatley U.D.C. Group A concrete columns with sodium lamps and lanterns in Wilmslow Rd.—See 3 Mar. issue.

2 Apr.—Dublin. Electric wiring installation in Nurses' Home extension at Mercer's Hospital. Details from Delap and Waller, consulting engineers, 63 Lower Baggot St, Dublin. Deposit £10. 10s.

2 Apr.—Ipswich T.C. Supply and erection of 21 group A lanterns, control gear, etc., and 11 steel columns for fluorescent lighting in town centre. Borough Engineer and Surveyor, 19 Tower St. Deposit £1. 1s.

2 Apr.—Kilmarnock T.C. Supplies of electric lamps for all departments for year commencing 16 May, 1955. Burgh surveyor's office, 11 London Rd, Kilmarnock.

6 Apr.—Wandsworth B.C. Concrete columns and ancillary gear for groups A and B street lighting.—Advertised in 10 Feb. issue.

6 Apr.—Wandsworth B.C. Sodium discharge lamps and jackets for route J.—Advertised in 24 Feb. issue.

7 Apr.—Belfast T.C. 3,300 V and 400 V switchgear and accessories. Also (closing date **24 Mar.**) extensions of coal handling plant.—Advertised in 10 Feb. issue.

7 Apr.—Belfast T.C. Electrical installation in Orangefield secondary intermediate school for boys. Education Architect, 40 Academy St.

7 Apr.—Glasgow T.C. Supplies of electrical accessories to the Lighting Department for one year from 1 June. Lighting Dept., 20 Trongate, Glasgow, C.1.

14 Apr.—Plymouth T.C. Six electrically-driven pumps for Water Dept.—See 10 Mar. issue.

18 Apr.—Nottingham T.C. (*a*) Provision of steel tubular light columns, and (*b*) of 140 W cut-off sodium lighting equipment for section of trunk road A.614. Lighting Engineer, 3 George St, Nottingham. Deposit £2. 2s.—Advertised in this issue.

21 Apr.—Belfast T.C. One bulldozer for moving coal at power station West coal store. Details for consulting engineers, Merz and McLellan, Carliol House, Newcastle-upon-Tyne, 1. Deposit £5. 5s.—Advertised in this issue.

2 May—Kingston-on-Hull T.C. Supply, erection, etc., of diesel engines, alternators, electrically driven centrifugal borehole and booster pumps, electric motors, switchgear, etc., at Springhead pumping station. T. H. Jones, Water Engineer and Manager, Guildhall. Deposit £5. 5s.

18 May—Dublin T.C. Electrically-driven sewage pumps for Clontarf station.—See 24 Feb. issue.

No date stated.—Lanark C.C. Electrical work in proposed Registration offices, Uddingston. Apply to W. R. Watt, county architect, 34 Albert St, Motherwell, by 19 Mar.

No date stated.—Lancashire C.C. Electrical installation at Padgate Training College. Apply to County Architect, P.O. Box No. 26, Preston, by 21 Mar., quoting ref. A/MG.

No date stated.—Lancashire C.C. Electrical installation at Lancaster Fair Elms Hotel for Aged Persons. Apply to County Architect, P.O. Box No. 26, Preston, by 24 Mar., quoting ref. A/MG.

No date stated—West Fife. Electrical work at Northern Hospital, Dunfermline.—See 10 Mar. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

31 Mar.—New Zealand. Supply of 250 mercury vapour street lighting fittings (250 W and 400 W) for Auckland Electric Power Board. Nuffield St, Newmarket. Tenders invited by Auckland City Council, Town Hall. B.o.T. (Ref.: ESB 4567/55).*

5 Apr.—Australia. Supply of diesel generating plant for telecommunication installation. Tenders invited by Commonwealth, Australia Hse., Strand, London, W.C.2. Ref.: Sch. C.7229.

5 Apr.—S. Rhodesia. City of Salisbury invite tenders for annual supply of transformers. Documents from Municipal Stores, P.O. Box 1169, Salisbury. Contract S.62/55. B.o.T. (Ref.: ESB 4573/55).*

5 Apr.—S. Rhodesia. Annual supply of switchgear, fuse gear and ancillary gear, including oil circuit-breakers, transformers, multicore cables, busbars, etc., for City of Salisbury. Contract No. S.61/55. Bids to Town Clerk, P.O. Box 990, Salisbury. B.o.T. (Ref.: ESB 4572/55).*

6 Apr.—S. Rhodesia. Supply of various quantities of h.v. and l.v. cables and conductors to various specifications. Contract E184/1955. Electricity Dept., City of Bulawayo. B.o.T. (Ref.: ESB 5017/55).*

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 126 queries answered this week

"Mardrive" clutch motors, makers of? P.B.—Marine Eng. Co. (Stockport) Ltd., Bulkey St, Edgeley, Stockport, Ches.

Device for stretching rubber ferrules over the ends of flexibles, suppliers of? H.T.G.—Hellerman Ltd., Tinsley Lane, Crawley, Sussex; Siegrist-Orel Ltd., 39 Berners St, W.1.

"Porto-power" tools, agents for? J.W.—E. P. Barrus Ltd., Brunel Rd, W.3.

"E.M.P." 11 kV cartridge fuses, makers of? S.W.B.—E.M.P. Electric Ltd., Garman Rd, N.17.

Babies bottle warmers, makers of? A.W.—Santos Mfg. Co., Ltd., 5 Chalk Farm Rd, N.W.1; David Griffin Ltd., Wimborne Rd, Poole, Dorset; Thermolectrics Ltd., Chapel Works, Church St, Hampton-on-Thames; H. E. Lewis, 67 Welbeck St, W.1; Churn Co., Hailsham, Sussex.

"Mopump" pump unit, makers of? T.E.—Rhodes, Brydon and Youatt Ltd., Gorsey Mount St, Stockport.

"Toastmaster" toaster, agents for? Y.B.—Frank V. Magrini Ltd., 24 Royal College St, N.W.1.

11 Apr.—Iraq. Supply and erection of two alternator sets of 500 kW and 250 kW resp. with switchgear at Ramadi. Documents from Directorate General of Municipalities, Baghdad. B.o.T. (Ref.: ESB 4425/55).*

11 Apr.—Iraq. Supply, erection of two transformers, each 1,000 kVA, to Ramadi Electricity and Water Board. Tender No. 93. Directorate General of Municipalities, Baghdad. B.o.T. (Ref.: ESB 4426/55).*

12 Apr.—Iraq. Directorate General of Municipalities, Baghdad, require three diesel electric generating sets, 50 kW, a.c., 230/400 V, 3-phase, 50 cycles, to be operated in Town of Hit. Tender No. 94. B.o.T. (Ref.: ESB 4427/55).*

13 Apr.—Australia. Supply, erection, etc., of coal handling plant of belt conveyor type at Yallourn power station. Specif. No. 54-55/156. State Electricity Commission of Victoria, 22-32 William St, Melbourne. B.o.T. (Ref.: ESB 3517/55).*

14 Apr.—Egypt. Overhead transmission line for connection of Cairo South and Tabbin power stations to Cairo Ring Main and extension to Basatin switching station. Documents from Egyptian Embassy, 24 South St, London, W.1, at £E7.

15 Apr.—Philippines. National Power Corporation, Manila, require two hydraulic turbines, two governors, and two inlet valves, and/or two generators, a power transformer, complete switchgear for Agusan River Hydro-Electric project. B.o.T. (Ref.: ESB 3461/55).*

16 Apr.—Iraq. Directorate General of Municipalities, Baghdad, invites tenders for supply and erection of 200 kW generating set with switchboard, etc., for Musayab. Tender No. 95. B.o.T. (Ref.: ESB 4428/55).*

18 Apr.—Iraq. Tenders invited for supply and erection of three 50 kW alternator sets at Aziziya. Directorate General of Municipalities, Baghdad. B.o.T. (Ref.: ESB 4887/55).*

20 Apr.—S. Rhodesia. Supply, etc., of 3-phase oil-immersed air natural cooled. outdoor-type 11,000/400 V Delta/Star transformers with oil and accessories. Contract E.183/1955. City of Bulawayo's Electricity Dept. B.o.T. (Ref.: ESB 4321/55).*

27 Apr.—Australia. One 160 kW, 430 V, a.c. alternator with exciter, for Hughenden T.C. Tenders to secretary, State Electricity Commission, Scottish Union Hse, Eagle St, Brisbane. B.o.T. (Ref.: ESB 4928/55).*

4 May.—Australia. Supply of one internal combustion engine driven generating plant for Blackhall Shire Council. Continuous rated output of about 150 kW, alternatively 190 kW, with engine operating as gas engine. Specification No. 489. State Electricity Commission of Queensland, Scottish Union Hse, Eagle St, Brisbane. B.o.T. (Ref.: ESB 3627/55).*

5 May.—Iraq. Supply and installation of electrical services and/or air conditioning for new Baghdad Museum of Antiquities. Contracts SS1/1955 and SS2/1955. Documents available at Iraqi Embassy, 22 Queen's Gate, London, S.W.7.

30 May—Portuguese E. Africa. Supply of 66 items of electrical equipment including 240 iron insulator supports, 48 insulators, 708 porcelain supports f • resistances, etc.; tender no. 20/55. Also supply of 53 other items including vacuum cleaner, fluorescent tubes, switches, etc.; tender no. 30/55. Port, Railways and Transport Dept., Laurenco Marques. B.o.T. (Refs.: ESB 4848/55 and 4849/55).*

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 15 March

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	343	−1	233
„ (3 months)	332½	+4	224½
LEAD, refined pig, min. 99·97% purity (cash)...	104	+1	85½
„ (3 months)	103	+1	83½
TIN, refined, min. 99·75% purity (settlement)	709	+2	726
„ (3 months)	712	+2	680
ALUMINIUM, ingots 99·99·5%	163	—	156
ZINC, virgin, min. 98% purity (cash)	89	+1½	73½
„ (3 months)	87½	+¾	72½
RUBBER No. 1, RSS, spot (per lb.)	26⅝d.	+1d.	16½d.
„ c.i.f. basis, ports, May (per lb.)	25⅝d.	+1d.	16 7/16d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52½	—	52
Mild Steel Tape (0·014 in.)	41½	—	40½

6 June—Australia. Snowy Mountains Hydro-Electric Authority require various electric controls for jet flow and ring follower gates at Tumut Pond Dam. Chief Administrative Officer of Authority, Box 4900, G.P.O., Sydney. Contract No. 50,021. B.o.T. (Ref.: ESB 4740/55).*

21 June—New Zealand. Tenders invited for 184 220 kV single circuit galvanised steel transmission line towers, comprising tower bodies, body extensions, leg extensions, earthwire extensions, etc. Contract 267. State Hydro-Electric Dept., Wellington. B.o.T. (Ref.: ESB 4308/55).*

26 Aug.—India. Equipment for Gandhi Sagar power station of Chambal project, Madhya Bharat, comprising mainly: three sets hydro-electric generating plant with 34,000 h.p. turbines, 23,000 kVA generators, etc.; 11/132 kV step-up transformers; 132 kV switchgear, 400 V a.c. switchboards, etc.; cables. Director General of Supplies and Disposals, New Delhi. B.o.T. (Ref. ESB 5032/55).*

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Permagrip. 737,968. Class 6. Metal clamps for conductors, etc. Essandem Works and McPherson Ltd., 16 Princip St, Birmingham 4.

Cantata. 734,777. Class 9. Electrical and acoustic apparatus, etc. Pye Ltd., Radio Works, St. Andrews Rd, Cambridge.

Elliotomation. 736,410. Class 9. Electrical and mechanical measuring, testing, indicating, recording and control instruments, etc. Elliott Bros. (London) Ltd., Century Works, Lewisham, S.E.13.

Cronapress. 737,541. Class 9. Bell systems. Cronapress Co., 19 Goodshaw Ave, Crawshawbooth, Rossendale, Lancs.

Sievector. 737,358. Class 11. Convection heaters. Siemens Electric Lamps and Supplies Ltd., Caxton Hse, Tothill St, S.W.1.

Credamatic. 737,673. Class 11. Cooking stoves and water heating. Simplex Electric Co., Ltd., Broadwell, Oldbury, near Birmingham.

Sunbeam, G.D.H. Product, Huddersfield, in design. 731,162. Class 11. Lighting fittings, reflectors, water heaters and fans. G. D. Harrison and Sons Ltd., 55 Northgate, Huddersfield.

Simplex Protector. 732,620. Class 9. Switches, etc. Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.

Lattilite. 736,910. Class 11. Lamps for vehicles. J. R. Gales, Iris Court, Pangbourne, Berks.

TRADE NOTES

New Branch. The English Electric Co., Ltd., have opened a new sub-office at Barclays Bank Chambers, 3 Trinity Hse Lane, Hull (telephone 35533), to cover an area that corresponds to No. 6 subarea to the Yorkshire Electricity Board. Mr M. S. R. Thompson is in charge.

Change of Name. The Electric Furnace Co., Ltd., is to change its name to "EFCO Ltd." The board plans to rearrange the subsidiaries so that the company will become virtually a holding company. Electronic Controls Ltd., will assume the name "Electric Furnace Co., Ltd."

Interest Sold. Because of the possibility of heavy death duties a 51% interest in Regentone radio and television group has been sold by Mr W. Harries to Lloyd's Packing Warehouses (Holdings) Ltd. Mr Harries has built up the Regentone business tremendously since the war.

New Phone No. The telephone number of A. F. Bulgin and Co., Ltd., at Bye Pass Rd, Barking, has been changed to Rippleway 5588.

Beama Contract Price Adjustment Formulæ.—*For Electrical Machinery and Equipment.* For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 Mar., 1955, shall be deemed to be 150s. 6d.*; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry published in the Board of Trade Journal on 12 Mar., 1955, is 183·1.

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 Mar., 1955, shall be deemed to be 150s. 6d.*; (*b*) "Cost of Material"—the index figures published in the Board of Trade Journal on 12 Mar., 1955, are: Materials used in Mechanical Engineering Industries—163·8, "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)"—147·7. The price of brass condenser tubes, ¾ in. o/d 18 s.w.g. published in *The Metal Bulletin* on 11 Mar., is 4s. 2¼d. per lb.

For outstanding Contracts covered by the B.O.T. Intermediate Products Index. For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 Mar., 1955, shall be deemed to be 150s. 6d.* (*b*) "Cost of Material"—the index figure for Intermediate Products published in the Board of Trade Journal on 12 Mar., is 374·1. *Pay is 162s. from 14 Mar.

BUSINESS PROSPECTS

Home

Belfast T.C. Erection of 85 houses and eight flats on Clara Park estate. Housing Architect's Dept., 94 Chichester St.
Blackburn. Newman's Slippers Ltd. to build new factory in Regent St.
Brighton T.C. Erection of secondary mixed grammar school at Stanmer. Borough Engineer and Surveyor, 26-30 King's Rd.
Carlisle. Long-term proposals of Regional Hospital Board include replacement of electrical services at General Hospital and reorganisation of installation at Keswick Cottage Hospital and Workington Infirmary.
Carlisle. Harraby secondary school (£103,000) educationally sub-normal children's school (£35,000), and Morton infant school (£39,000) likely to be included in 1956-57 building programme, as well as extensions to high school for girls (£26,000) and additions to College of Art (£50,000).
Cheshire. I.C.I. Ltd. has placed contract with John Laing and Son Ltd. for erection of new laboratory at Alderley Edge.
Chesterfield. Further work to be carried out at College of Technology at estimated cost of £104,000.
Chichester. Plans in hand for factory extensions and offices on Terminus Rd industrial estate for Hambling Industries Ltd.
Cornwall. Plans approved for secondary school in St. George's Rd, Hayle.
Devon. Ashburton secondary school (£79,000) and Ivybridge secondary school (£134,000) to be added to 1955-56 building programme.
Dunfermline. Extensions to McCrone Pre-nursing school at Fod Hse has been approved. Cost estimated at £75,000.
Durham. Permission sought to include erection of R.C. West View modern school (£93,000), and Hebburn R.C. grammar/technical school (£120,000) in 1955-56 building programme.
Exeter. Shell-Mex and B.P. Ltd., propose erection of oil storage depot costing about £50,000.
Felling (Dur). Plans approved for canteen in Stoneygate Lane for International Paints Ltd.
Glasgow. Plans submitted for factory and offices in South St for W. Fearnhough Ltd.
Gosport T.C. Construction of 204 houses on Rowner estate. Borough Engineer and Surveyor, Town Hall.
Grimsby T.C. Erection of 104 houses on Scartho estate. J. V. Oldfield, Borough Engineer and Surveyor, Municipal Offices, Town Hall Sq.
Holborn. New office building of 70,000 sq ft to be built in Holborn and Fetter Lane. Architects are Yates, Cook and Derbyshire, 43 Great Marlborough St, W.1.
Ilford. Tenders to be invited soon for erection of factory, offices, etc., in High Rd and Highbury Gdns. Douglas Bernhardt and Associates, architects, 3 Eagle St, W.C.1.
Inverness. Scottish Industrial Estates to build three factories on Longman industrial estate. Scheme approved.
Isle of Ely. New kitchen and dining room to be built at Hereward school, March.
Kingsclere and Whitchurch (Hants) R.D.C. Scheme approved for erection of 91 houses at Dellands and Sapley Lane, Overton.
Letchworth. Third instalment of the North Herts Technical College is estimated to cost £167,927.
Lewisham. Oswald E. Parratt, Adelaide Hse, London Bridge, E.C.4, likely to be quantity surveyor for reconstruction and extension of town hall.
London. H. White and Son Ltd. to build factory in Park Royal Rd, N.W.10.
Ludlow (Salop) T.C. Layout plans approved for 300 houses on Sheet Rd site.
Lytham St. Annes. Ditchburn Equipment Ltd., planning factory extensions in Dock Rd.
Manchester T.C. Erection of total of 423 houses, bungalows, maisonnettes and flats on various sites. Director of Housing, Town Hall.
Newcastle-on-Tyne. R. W. Bell and Co., Ltd., of Mistletoe Rd, are planning erection of multi-storey block of business premises in New Bridge St. Cost will be about £200,000.
Newton Abbot. Approval granted for erection of block of shops and flats on Buckland estate.
Nuneaton T.C. Construction of 65 houses in Abbotsford Rd, 16 old people's cottages in Arbury Rd and 12 similar cottages on Tuttle Hill. Borough Surveyor, Council Hse.
Penrith U.D.C. Plans approved for clothing factory at Gilwilly for Redmayne and Sons Ltd.
Petersfield (Hants). Plans being prepared for mixed secondary modern school.
Port Talbot T.C. Erection of 200 houses at Sandfields. G. V. Griffiths, Borough Engineer, Municipal Buildings.
Portsmouth. Architect for additions to factory in Anson Rd for Solent Furniture Products Ltd. is R. Lewis Reynish, Kent Lodge, Queen's Crescent, Southsea.
Redditch U.D.C. Erection of 200 houses on Studley Rd site. E. Buckley, Engineer and Surveyor, Council Hse.
St. Albans. R.C. authorities planning a grammar school on St Stephen's Hill.
Sacriston (Dur). Construction of new cinema. Architects are Eltringham and Lowes, Derwent St, Blackhill.
Scunthorpe T.C. Seventy houses and bungalows to be built at cost of £95,440.
Slough (Bucks). Application may soon be made by C.C. to borrow £85,952 for erection of magistrates' and county courts.
Slough. Aspro Ltd. to build a large factory on the Bath Rd. Architect is E. D. Jefferis Mathews, 3 Ebury St, London, S.W.1.
Smethwick. Final plans submitted for final instalment of Sandwell secondary schools to cost about £210,500.
South Shields T.C. It is proposed to spend £2,704 this year on improvements to electrical installations in 228 old council houses.
South Shields. Ravenself Properties Ltd. are considering erection of 3-storey office block and shops in South Shields Market. Architects are Fewster and Partners, 22 Conduit St, London, W.1.
South Shields. Extensive alterations and additions to be carried out at Ingham Infirmary.
Stirling. Dean of Guild Court has approved plans for conversion of office block into restaurant, etc., for R. L. Ballantyne, M. A. Blyth, R. R. Blyth, and I. Burn-Murdock of 18-20 Maxwell Place.
Stockton. Universal Tyre Co., Ltd., have been offered site by T.C. for erection of factory.
Sunderland T.C. It is proposed to erect workshops and classrooms at Technical College. Messrs Joplins have obtained site in John St for erection of four-storey premises. Architects are S. W. Milburn and Partners, 9 Esplanade.
Tottenham B.C. Erection of 56 dwellings in Markfield redevelopment area. Borough Engineer, Town Hall, N.15.
Wandsworth. It is proposed to erect secondary school in Burntwood Lane at estimated cost of £628,000.
Wanstead and Woodford T.C. Erection of 18 flats and 48 houses at Woodford Bridge. Council's Architects, Tooley and Foster, Midland Bank Chambers, Buckhurst Hill.
West Ham. Plans submitted to Ministry for proposed Stratford grammar school.
Wisbech. Queen's secondary boys' school is estimated to cost £209,963.

Gazette Announcements

COMPANIES ACTS

Accessories Supply Co., Ltd. Liquidator, J. B. G. Moore, Official Receiver of 25 Queen St, Sheffield, released as from 17 Feb.
M.P. Stainless Products Ltd. Last day for receiving proofs in respect of intended dividends, 22 Mar. Liquidator is T. J. M. Macleod, 4 Bucklersbury, London, E.C.4.
West Wales Electric Ltd. Resolution for voluntary winding-up passed at meeting on 9 Sept., 1954. Creditors are asked to send particulars to B. Smith, C.A., Liverpool Hse, Penlan St, Pwllheli, by 31 Mar.
Commercial Refrigeration Ltd. Resolution for voluntary winding-up passed at meeting on 1 Mar., when C. H. Kershaw of Fargate Hse, Fargate, Sheffield, was appointed liquidator.
A. W. Lines Ltd. First and final dividend of 2s. 10d. in £. payable on 1 Apr. at office of Water House, 418/422, Strand, W.C.2.
R. Barden Ltd. First and final dividend of 8¾d. in £. payable on 11 Mar. at office of Official Receiver and Liquidiser, Inveresk Hse, 346, Strand, W.C.2.

Application for Discharge

Stoke-on-Trent. Douglas G. Edwards, electrical engineer trading at 8 Blackfriars Rd, Newcastle-under-Lyme. Hearing fixed for 20 Apr. at Town Hall, Hanley, at 10.30 a.m.

BANKRUPTCY ACTS

Receiving Orders

Stafford. Ronald T. Tisdale, electrical engineer of High St, Grosall. Date of receiving order, 5 Mar.
Edmonton. Ronald L. Dries, radio engineer, formerly of 50 Hoe St, E.17. Public examination will be at The Court Hse, Upper Edmonton, N.18, on 20 May, at 11 a.m.

First Meetings

Kingston-Upon-Thames. Charles J. Callander, electrical dealer, of 60 Beverley Way, West Wimbledon. Meeting taking place tomorrow (18 Mar.) at 58/61, York Terrace, N.W.1, at 11 a.m.

MEETINGS TO NOTE

THURSDAY, 17 MAR.

I.E.E. (London Utilisation and Supply). "Standardisation of Retail Electricity Tariffs." A. O. Johnson and N. F. Marsh. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (N. Eastern). "Possibilities of Cross-Channel Power Link between British and French Supply Systems." D. P. Sayers, M. E. Laborde and F. J. Lane. King's Hall, Globe Lane, Carlisle, 7 p.m.

E.W.F. Annual meeting and dinner. Both at Dorchester Hotel, London.

BRITISH INSTN. OF RADIO ENGRS. (Scottish). Symposium of Short Papers by Members. University, Edinburgh, 7 p.m.

CHELMSFORD ENGRNG. SOC. "Colour TV." L. C. Jesty. Hoffman's Social Hall, 7.30 p.m.

A.S.E.E. (Watford). "Earthing." T. C. Gilbert. Clarendon Hotel, Station Rd, 8 p.m.

FRIDAY, 18 MAR.

I.E.E. (N.E. Students). "Some Electronic Applications to Chemical Analysis." M. S. Beck. King's College, Newcastle, 6.30 p.m.

LEICESTER ELECTRICAL SOC. Annual dinner dance at Grand Hotel.

E.P.E.A. (Southern Meter Engrs.). Brains Trust. Caxton Hall, Westminster, 6.30 p.m.

INST. OF FUEL (E. Midland). "Application of Gas Turbines to Industry." Loughborough College, 7.15 p.m.

INST. OF MECHANICAL ENGRS. Annual meeting at 1 Birdcage Walk, S.W.1, 5.30 p.m.

I.E.E. (N. Midland). Annual dinner and dance at Cairn Hydro Hotel, Harrogate, 7.15 p.m.

MONDAY, 21 MAR.

I.E.E. (London Radio). Discussion on "Materials for Valves." R. O. Jenkins. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (Mersey and N. Wales). "Current Summations with Current Transformers." A. Hobson. Town Hall, Chester, 6.30 p.m.

I.E.E. (N.E. Measurements and Radio). "Fundamental Electromagnetic Theory." P. Hammond. King's College, Newcastle, 6.15 p.m.

I.E.E. (Western Utilisation). "Artificial Respiration." C. E. Dew. Elect. Hse, Colston Ave, Bristol, 6 p.m.

I.E.S. (Leeds). Address by H. G. Campbell, vice-president. Elect. Offices, Ferensway, Hull, 7.30 p.m.

IPSWICH ELECTRICAL ASSOC. "Modern Methods of Heating Buildings." J. R. Harrison. Electric Hse, 7.30 p.m.

BIRMINGHAM ELECTRIC CLUB. Annual meeting. "Reminiscences Concerning the Land of Contentment." M. O. Jackson.

TUESDAY, 22 MAR.

I.E.E. (London Education). Discussion on "High-Voltage Equipment in Colleges." T. Siklos. Savoy Place, W.C.2, 6 p.m.

I.E.E. (London Supply). Section dinner dance at Cafe Royal, 7 p.m.

I.E.E. (N. Midland Utilisation). Short papers evening. Elect Offices, 1 Whitehall Rd, Leeds, 6.30 p.m.

I.E.E. (N.W. Measurements). Discussion on "Servicing of Electronic Measuring Instruments and its Effect on their Design." D. Taylor. Engr's. Club, Albert Sq, Manchester, 6.15 p.m.

I.E.E. (Scotland). Faraday lecture: "Courier to Carrier in Communications." T. B. D. Terroni. Central Halls, Tolkross, Edinburgh, 7 p.m.

I.E.E. (Rugby). "Transatlantic Telephone Cable." M. J. Kelly, Sir W. Gordon Radley, G. W. Gilman, and R. J. Halsey. College of Technology and Arts, 6.30 p.m.

I.E.E. (London Students). "Taming of Graduates." J. M. Armstrong. Public Library, Chelmsford, 7 p.m.

COVENTRY ELECTRIC CLUB. Film Show. Sports and Social Club, Merrick Lodge, St. Nicholas St.

E.A.W. Caroline Haslett Trust Lecture: "Focus on Finland," by Miss M. J. Cumming, I.E.E., Savoy Place, W.C.2.

TV SOCIETY. Annual dinner at Dorchester Hotel.

A.S.E.E. (London). Prize-winning papers in 1954-55 Highfield Shield Comp. 2 Savoy Hill, W.C.2, 6.30 p.m.

WEDNESDAY, 23 MAR.

I.E.E. (London Supply). "Proving Performance of Circuit-Breakers, particularly those of Large Breaking Capacity," J. Christie, H. Leyburn, and J. F. Bird; "New Testing Station for High-Power Circuit-Breakers," J. Christie, H. Leyburn, and R. W. Fenn. Savoy Place, W.C.2, 5.30 p.m.

I.E.E. (S.W. Scotland). "Electrification of Manchester-Sheffield-Wath Lines of B.R." J. A. Broughall and K. J. Cook. 39 Elmbank Cresc, Glasgow, 7 p.m.

I.E.E. (N.E. Students). "Some Electronic Applications to Chemical Analysis," M. S. Beck. Cleveland Scientific and Tech. Inst., Middlesbro', 6.30 p.m.

BELFAST ASSOC. OF ENGRS. "Radio-Active Isotopes and Their Industrial Uses," N. H. Lawden. College of Technology, 7.30 p.m.

I.E.E. (Southern Centre). "A Criterion of Distribution Cost," D. J. Bolton. Southampton University, 7 p.m.

THURSDAY, 24 MAR.

I.E.E. (S. Western). "Aluminium-Sheathed Cables," P. M. Hollingsworth and P. A. Raine. Elect. Showrooms, New George St, Plymouth, 3 p.m.

I.E.E. (Irish). "Submerged Telephone Repeaters for Shallow Water," R. J. Halsey and F. C. Wright. Trinity College, Dublin, 6 p.m.

NOTTINGHAM ELECTRICAL CLUB. "Electron Microscope," W. J. Lloyd. Reform Club, Victoria St, 7 p.m.

FRIDAY, 25 MAR.

I.E.E. (N. Scotland). Faraday lecture: "Courier to Carrier in Communications," T. B. D. Terroni. Caird Hall, Dundee 7 p.m.

I.E.E. (N. Eastern). "Brushless Variable-Speed Induction Motor," F. C. Williams and E. R. Laithwaite. Workington Tech. College, 7 p.m.

I.E.E. (N. Eastern). Annual dinner and dance. Old Assembly Rooms, Newcastle, 7 p.m.

I.E.E. (Rugby). I.E.E./R.E.S. Ball at Chesford Grange Hotel, Kenilworth, 8.30 p.m.

I.E.S. (Bath and Bristol) "Shop and Store Lighting," R. L. C. Tate. Elect. Offices, Old Bridge St, Bath, 7 p.m.

I.E.S. (Birmingham). Meeting at B.T.H. Lecture Theatre, Rugby.

MANCHESTER ASSOC. OF ENGRS. Annual meeting. "Engineering Problems Associated with Production and Operations at Low Temperature," H. E. Charlton. Engrs. Club, Albert Sq, 6.45 p.m.

ELECT. TRADES COMMERCIAL TRAVELLERS ASSOC. (Midlands). Annual ladies' evening at Queens Hotel, Birmingham, 6.45 p.m.

CHELMSFORD ENGRNG. SOC. Conversazione at Cromptons' Social Centre, 7.15 p.m.

INSTN. OF MECHANICAL ENGRS. "Hydraulic Transport of Solids," R. C. Worster and D. F. Denny. 1 Birdcage Walk, S.W.1, 5.30 p.m.

A.S.E.E. (N.W. London). "Industrial Switchgear and Circuit-Breakers." Century Hotel, Forty Ave, Wembley Park, 8.15 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

Brayburne Electrics Ltd. Electrical engineers and contractors, etc. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Jean Herbert and Claire Moore, 156 Strand, W.C.2.

M.E.C. Transmissions Ltd. Manufacturers and manufacturers' agents of motor, electric and ignition appliances and accessories, etc. Nom. cap.: £1,000. Dirs.: not named. Subs.: A. C. Askwith and A. W. Paterson, 1 Threadneedle St, E.C.2.

Electronic Supplies (Huddersfield) Ltd. Nom. cap.: £1,000. Dirs.: not named. Subs.: G. Suttie, 32 School Lane, Berry Brow, Huddersfield, and T. Ledger, 170 Moor Lane, Netherton, nr. Huddersfield.

Grundig International Ltd. Merchants, financiers, etc. Nom. cap.: £10,000. Dirs.: not named. Subs.: Grundig (Gt. Britain) Ltd., address not stated. A. E. Johnson, School Green Farm, North Weald, Essex.

Canadian Electric Washing Machine Co. (Croydon) Ltd. Y.M.C.A. Buildings, 14 Bond St, Ealing, W.5. Nom. cap.: £2,000. Dirs.: R. A. Frost and Patricia K. Frost.

H. C. Avery Ltd. Thames Side, Kingston-on-Thames, Surrey. Electrical engineers and contractors, electricians, radio engineers, etc. Nom. cap.: £100. Dir.: H. C. Avery.

Phosco Ltd. 3 St. Helen's Place, E.C.3. Manufacturers of and dealers in street lighting, lanterns, etc. Nom. cap.: £20,000. Dirs.: C. A. Marques and C. R. Belling.

Potter's Electrical Repair Works Ltd. Delhi St, Swansea. Nom. cap.: £8,000. Dirs.: A. L. Potter, Mrs. M. E. Potter and A. Potter.

Charles Colston Ltd. Manufacturers of and dealers in articles, apparatus, utensils, commodities and equipment of a household, domestic or personal nature; electrical, mechanical and general engineers, etc. Nom. cap.: £100. Dirs.: Not named. Subs.: C. B. Colston, A13, Albany, Piccadilly, W.1; and M. Colston, The Danes, Penn, Bucks.

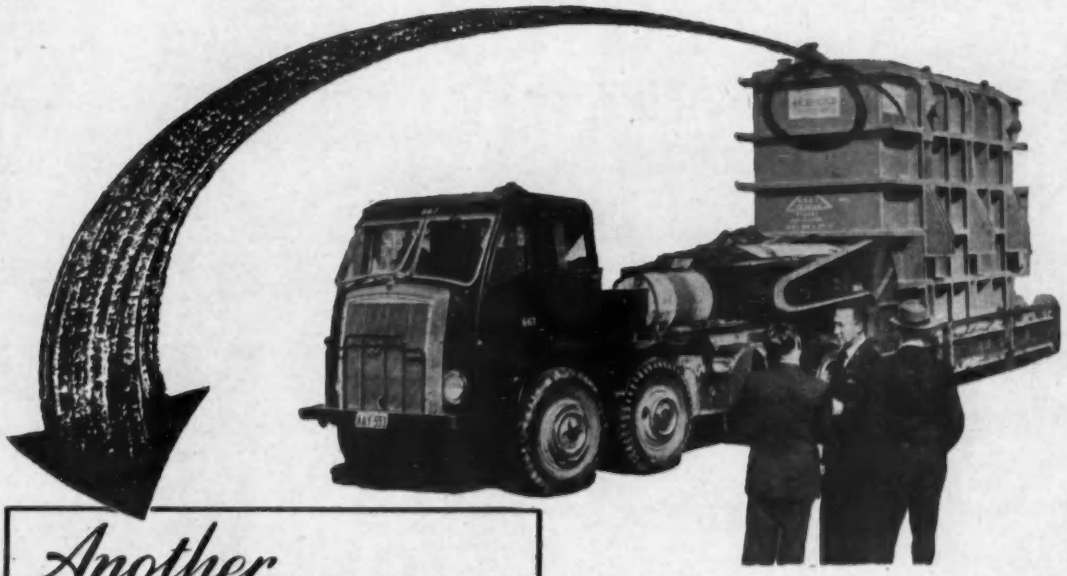
A. J. Statham (St. Albans) Ltd. Dealers in and repairers of radio, television, electronic and associated devices, etc. Nom. cap.: £500. Dirs.: Not named. Subs.: C. R. P. Goodwin, 12 Marlborough Place, Brighton; and Viola G. Maynard, 101 Springfield Rd, Brighton, 6.

Solartron Electronic Business Machines Ltd. Nom. cap.: £100. Dirs.: To be appointed by subs. Subs.: J. E. Bolton, Brook Place, Chobham, Surrey, and B. Scott, 46 Wimbledon Close, The Downs, S.W.20.

Electronic Components Ltd. Electronic, radio and television engineers, etc. Nom. cap.: £100. Dirs.: H. G. Pitt, 11 Halt Rd, Rhigos, Glam, and Mrs E. Davies, 3 Neath Rd, Rhigos, Glam.

Civil and Marine Ltd. 17 St. Helen's Place, E.C.3. Marine engineers, carpenters, woodworkers, canvas, wire and metal workers, mechanical and electrical engineers, etc. Nom. cap.: £2,000. Dirs.: J. K. Laurence, 17 St. Helen's Place, E.C.3.

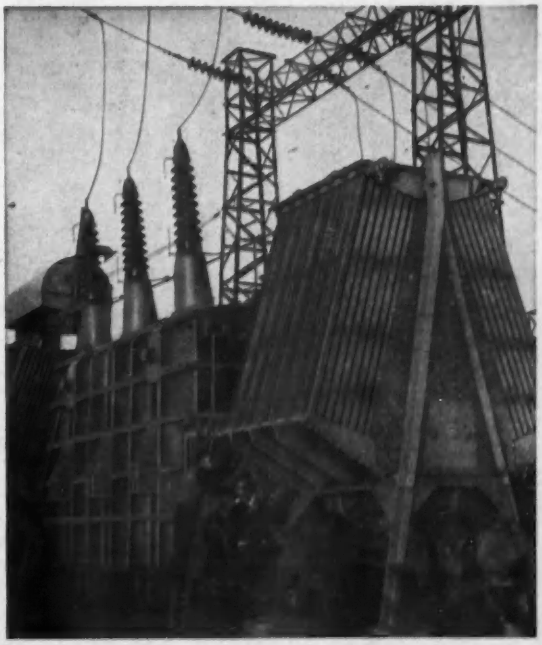
Samuel Simister and Co., Ltd. Croston St, Bolton. To take over business of tin plate and sheet metal workers carried on as "Samuel Simister and Co." at Bolton. Nom. cap.: £5,000. Dirs.: S. Simister, F. Simister, N. Simister and H. Parkinson.



Another HACKBRIDGE TRANSFORMER FOR SERVICE OVERSEAS

MONTH after month large Hackbridge transformers leave the Works for destinations extending to the most distant parts of the world. The illustrations show the arrival and installation of one of five 30,000 kVA 132/33 kV type ON/OB Hackbridge transformers for the Electricity Commission of New South Wales.

Over 21 million kVA of Hackbridge transformers have been manufactured, including some of the world's largest units.



HACKBRIDGE TRANSFORMERS

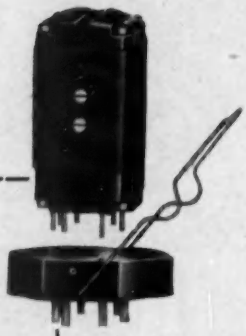
Made in Britain by

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone: Walton-on-Thames 760 (8 lines) *Telegrams: "Electric, Walton-on-Thames"*

Weston *Moving Coil* Relays

FOR A WIDE VARIETY OF APPLICATIONS

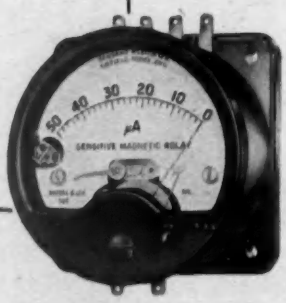
The simplicity and reliability of relay control has led to the ever increasing use of WESTON MOVING COIL RELAYS. Let us have a note of your relay problems and we will be pleased to advise on the most suitable model for any set of conditions. Enquiries should be accompanied by full particulars of both control and local circuits.



MODEL S115. A relay of extremely small size, functioning as an 'on-off' switch. Can be operated on a power input as low as 5 microwatts.

MODEL S54. A relay of extreme sensitivity with wide applications in Laboratory and Industrial Control. The high torque developed by the moving system ensures positive contact pressure.

MODEL S124. A highly sensitive relay with magnetic hold-on contacts having a higher rating than those of the above models.



SANGAMO WESTON LIMITED

ENFIELD · MIDDLESEX *Tel: Enfield 3434 (6 lines) & 1242 (6 lines)* *Grams: Sanwest, Enfield*

SANGAMO WESTON

Scottish Factory: Port Glasgow, Renfrewshire. Port Glasgow 41151
Branches: London, CHAncery 4971 Glasgow, Central 6208 Manchester, Central 7904 Newcastle-on-Tyne, Newcastle 26867 Leeds, Leeds 30867 Liverpool, Central 0230 Wolverhampton, Wolverhampton 21912 Nottingham, Nottingham 42403 Bristol, Bristol 21781 Southampton, Soton 23328 Brighton, Brighton 28497

SW/2

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

CITY AND COUNTY BOROUGH OF BELFAST
Electricity Department

TENDERS are invited for the Supply, Delivery and Erection at the First Extension of Belfast Municipal Electric Power Station West of:

One Bulldozer for moving coal on the power station coal store, the nominal moving capacity being approximately 120 tons of coal per hour for a mean haul of 140 ft. The B.H.P. shall preferably be between 70 and 100.

Form of Tender (N.1664), Conditions, Specification and Drawings, in quintuplicate, may be obtained from Messrs Merz and McLellan, Consulting Engineers, Carliol House, Newcastle upon Tyne 1, on payment of a deposit of Five Guineas which will be refunded provided a bona fide tender is lodged and not withdrawn. Extra copies of the tender document may be obtained at One Guinea each; this sum will not be returnable. Cheques should be made payable to the Belfast Corporation Electricity Department.

Each tender, in quadruplicate, in sealed envelope marked "Tender for Mobile Coal Moving Equipment, Electricity Department" and endorsed with the name and address of the tenderer, must be addressed to the Town Clerk, City Hall, Belfast, so as to reach him not later than 4 p.m. on Thursday, 21 Apr., 1955.

An official receipt must be obtained for each Tender delivered by hand. Tenders sent by post should be registered.

The lowest or any tender will not necessarily be accepted.

EYRE GORDON,
Chairman,
Northern Ireland Joint Electricity Committee.

Chichester House,
Chichester St, Belfast.
10 Mar., 1955. (R 240)

CITY OF NOTTINGHAM
TRUNK ROAD NO. A.614
IMPROVED LIGHTING SCHEME

TENDERS are invited for the whole or part of the following works in connection with the provision of improved lighting of Group A standard on a section of Trunk Road No. A.614, 3,570 yards in length, within the City of Nottingham:

(*a*) Provision of STEEL TUBULAR LIGHTING COLUMNS.

(*b*) Provision of 140 W CUT-OFF SODIUM LIGHTING equipment.

General Conditions of Contract and plans may be seen and Specifications and Bills of Quantities obtained from the Lighting Engineer at his office at 3 George St, Nottingham, on payment of a deposit of £2. 2s., which will be refunded on receipt of a bona fide tender.

Tenders in plain sealed envelopes, endorsed "Lighting Scheme—Trunk Road" must be delivered to the undersigned not later than 5 p.m. on Monday, 18 Apr., 1955.

T. J. OWEN,
Town Clerk.

Guildhall,
Nottingham. (R 250)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18–64, or a woman aged 18–59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

SAO PAULO LIGHT AND POWER
Company Limited, Brazil

invite applications from suitably-qualified single men for the position of ASSISTANT SHIFT CHARGE ENGINEER in the Piratininga Power Station. The power station which has recently been completed is situated near Sao Paulo (pop. 2·5 millions; temperate climate; 2,200 ft above sea level). The plant comprises 2 x 80 MW, 1,800 r.p.m. steam turbo-alternator units, each supplied at 850 psi, 900° F by one 850,000 lb/hr oil-fired boiler. Applicants should have sound technical knowledge based on complete engineering course and practical training, including two or three years' apprenticeship in a modern steam plant followed by at least one year's experience as assistant shift charge engineer, or the marine equivalent. Good salary, three years' agreement subject to renewal with first class passage both ways; four months' paid leave after three years' service. Written application should be made to Mr W. P. Kellett, Joint Manager, Canadian-Brazilian Services Ltd., 148 Leadenhall St, London, E.C.3. (R 202)

LONDON ELECTRICITY BOARD
JUNIOR ENGINEER
(OPERATION AND MAINTENANCE)

APPLICATIONS are invited for the above position in the City District of the Northern Sub-Area.

Applicants should have had a sound technical education up to at least National Certificate standard, with practical experience in general mains work, including installation and maintenance of distribution systems, with the preparation and keeping of associated records.

The post is graded under the National Joint Board agreement as Class F, Grade 14, £500 per annum, rising to £546 per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46/7 New Broad St, London, E.C.2, to be returned completed by 31 Mar., 1955. Please enclose addressed envelope and quote ref.: V/1906/T. (R 214)

ESSEX EDUCATION COMMITTEE

SOUTH-EAST Essex Technical College and School of Art, Longbridge Rd, Dagenham.

Required 1 Sep., 1955.

ASSISTANTS GRADE A for ELECTRICAL INSTALLATION WORK.

Salary £450 x £18 to £725 plus London Allowance, with additions for approved experience, training and qualifications.

Application forms (returnable within 14 days) and details from Clerk to the Governors. (R 254)

SOUTH EASTERN ELECTRICITY BOARD
ASSISTANT DISTRICT ENGINEER
Woking District

SALARY £635 x £15—£680 under N.J.B. Class E, Grade 9. Superannuable. Applicants should hold the Higher National Certificate in Electrical Engineering, or its equivalent, and, in addition, must have had practical experience in general distribution work in systems up to 11 kV. A knowledge of estimating and the preparation of proposals for mains extensions an advantage.

Applications, naming 2 referees, on forms from J. C. Poole, A.M.I.E.E., Woking Manager, SEEBoard, 4 Chobham Rd, Woking, by 30 Mar., 1955.

ASSISTANT DISTRICT ENGINEER
Dover District

Salary £595 x £15—£640 under N.J.B. Class D, Grade 9. Superannuable. Applicants should hold the Higher National Certificate in Electrical Engineering, or its equivalent, and have practical experience in general distribution work on systems up to 11 kV.

Applications, naming 2 referees, to R. G. Widgery, A.M.I.E.E., District Manager, SEEBoard, Ladywell, Dover, Kent, by 30 Mar., 1955.

DISTRICT COMMERCIAL ASSISTANT
Worthing District

Salary £425 x £20—£525 under N.J.C. Grade 1. Superannuable. Applicants should have had experience in dealing with consumers enquiries and all classes of installation work, and have a good knowledge of domestic appliances and tariffs.

Applications, naming 2 referees, to M. J. Mortimer, M.I.E.E., District Manager, SEEBoard, 56 Chapel Rd, Worthing, by 30 Mar., 1955.

SUB-AREA SENIOR DEMONSTRATOR AND COMMERCIAL ASSISTANT
(Female)
Surrey Sub-Area

Salary £645/£720 under N.J.C. Grade 4. Superannuable. Applicants must have had a good education with training in Domestic Science and should hold the E.A.W. Diploma or equivalent qualification. The person appointed will be required to organise and conduct large scale demonstrations, be capable of lecturing to Women's organisations on domestic science subjects, have had experience in public speaking and be capable of assisting generally in the Commercial Department of the Sub-Area.

Applications, naming 2 referees, on forms from C. W. Hughes, B.SC., M.I.E.E., Surrey Manager, SEEBoard, Rough Rew, Horsham Rd, Dorking, Surrey, to be returned by 30 Mar., 1955.

A. L. BURNELL,
Secretary.
(R 232)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following posts at Little Barford Generating Station:

STATION SHIFT CONTROL ENGINEER

Salary Class G, Grade 10, £675 x £15—£720 per annum.

Applicants should have reached the standard of Ordinary National Certificate in Electrical Engineering or its equivalent, have experience in the operation of a Switchboard at a Generating Station and be fully conversant with High Tension Switching operation and protective systems.

JUNIOR ENGINEER

Salary Class G, Grade 15, £475 x £15—£520 per annum.

The duties of the successful applicant will include assisting in the Control Room on shift and other operation and investigation duties. Preference will be given to applicants who have had previous experience in a Generating Station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent.

Applications stating age, details of qualifications and experience should be sent to the Controller, British Electricity Authority Eastern Division, Northmet House, Southgate, N.14, not later than 26 Mar., 1955.

W. N. C. CLINCH,
Controller
(R 219)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF THIRD ASSISTANT ENGINEER (DESIGN AND PLANNING), SUB-AREA TECHNICAL ENGINEER'S DEPARTMENT, MANCHESTER

APPLICANTS should have received a technical education to H.N.C. level in Electrical Engineering and should preferably have served an engineering apprenticeship or received equivalent training.

Duties will include the preparation of schemes and estimates for extension of a large city network and associated protective gear.

Experience of the design and planning of systems up to 33 kV will be an advantage. Drawing office experience will be an additional qualification.

Salary Scale: £840 x £20—£900 per annum, Grade L.10, N.J.B. Conditions.

APPOINTMENT OF JUNIOR ENGINEER, POWER SALES SECTION SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, MANCHESTER

Duties will involve the preparation of heat loss calculations and matters relating to the development of the industrial and heavy commercial power loads.

Possession of technical qualifications (H.N.C. or Corporate Membership of the Institution of Electrical Engineers) will be an advantage.

Salary Scale: £475/£520 per annum, Grade L.19, N.J.B. Conditions.

Applicants should state age, present position and salary, details of technical training and previous experience.

APPOINTMENT OF SENIOR DEMONSTRATOR SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, MANCHESTER

Applicants must have had a good education with training in Domestic Science and hold the E.A.W. Diploma. The person appointed will be required to give lectures and demonstrations on all types of domestic appliances, advise consumers on the choice of equipment and must be capable of supervising staff and arranging the training and electrical education of trainees, assistants and demonstrators, up to E.A.W. Diploma standard.

Salary Scale: £645/£720 per annum, Grade 4, N.J.C. Conditions.

APPOINTMENT OF DEMONSTRATORS SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, MANCHESTER

Duties will include demonstrations, service calls and advice on housecraft problems, together with appropriate contact with local Women's Associations, etc. Applicants should possess a recognised Certificate in cookery or institutional management, the E.A.W. Certificate, and possession of the E.A.W. Diploma will be an advantage.

Salary Scale: £425/£525 per annum, Grade 1, N.J.C. Conditions.

Progress beyond £465 will be subject to a Certificate that the person appointed is capable of undertaking all the duties of the grade.

Applications for above posts to Sub-Area Secretary, No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, by 26 Mar., 1955.

APPOINTMENT OF SENIOR SALES REPRESENTATIVE (DEVELOPMENT) BURY DISTRICT

Duties associated with this position involve advising Consumers on their premises, on all matters normally concerned with Sales Development, i.e. tariff queries and apparatus sales for domestic and small commercial and industrial applications.

Experience in the application of electricity to agriculture and horticulture would be an advantage.

Applicants should possess the E.D.A. Sales Certificate and preference will be given to those who have taken courses of study in Electrical Engineering.

Salary Scale: £525/£585 per annum, Grade 2, N.J.C. Conditions.

Applications to Sub-Area Manager, No. 2, Sub-Area, The North Western Electricity Board, 2 St. George's Rd, Bolton, by 26 Mar., 1955.

APPOINTMENT OF THIRD ASSISTANT ENGINEER (PLANNING AND DESIGN) SUB-AREA ENGINEER'S DEPARTMENT, OLDHAM

Applicants should have had experience in the planning of H.V. and L.V. systems, estimating, system calculations and general

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technical investigations. Preference given to applicants who hold the H.N.C. (or equivalent) in Electrical Engineering.

Salary Scale: £790 x £20—£850 per annum, Grade K.10, N.J.B. Conditions.

APPOINTMENT OF FOREMAN (MAINS) OLDHAM DISTRICT

Applicants should be capable of supervising work in connection with cable jointing, cable laying and overhead line erection.

Salary: £595 per annum, Grade 2, Schedule E, N.J.I.C. Conditions.

Applications for the above posts to Sub-Area Manager, No. 3 Sub-Area, The North Western Electricity Board, Union St, Oldham, by 26 Mar., 1955.

APPOINTMENT OF (*a*) METER TESTER, BLACKPOOL: (*b*) METER REPAIRER (MECHANICIAN) PRESTON

Rate of pay: 49d. per hour. N.J.I.C. Conditions.

Applications to Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, by 26 Mar., 1955.

APPOINTMENT OF THIRD ASSISTANT DISTRICT COMMERCIAL ENGINEER (INSTALLATION INSPECTION) ROSSENDALE DISTRICT

Applicants should have a good knowledge of the appropriate regulations for the electrical equipment of buildings, etc., and have had experience in:

The erection, inspection and testing of all classes of electrical installations, routine meter fixing procedure, office organisation in connection with installation inspection and meter fixing and control of workmen.

Salary Scale: £635 x £15—£680 per annum Grade E.9, N.J.B. Conditions.

Applications to Sub-Area Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, by 26 Mar., 1955. (R 218)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination.

SENIOR ASSISTANT (COSTS) in the Accountant's Department, No. 2 Sub-Area, Eversley, Frodsham, Cheshire. Salary within range £645/£720 per annum. (N.J.C. Grade 4.)

Applicants should have experience in costing, budgetary control of expenditure and the invoicing of rechargeable work. Possession of an accountancy qualification an advantage.

The appointee will be directly responsible to the Cost Accountant, and will have an opportunity to gain worthwhile experience of the costing procedure of a large and progressive Industry.

Applications stating age, experience, and qualifications should be sent to the Manager, No. 2 Sub-Area, Sandiway Hse, near Northwich, Cheshire. Closing date: 28 Mar., 1955.

RECORDS DRAUGHTSMAN in the Engineering Department at the Board's Headquarters at Electricity Hse, Love Lane, Liverpool, 3. Salary within the range £425/£525 per annum. (N.J.C. Grade 1.)

Applicants should have some general experience in a drawing office of the preparation of plans and system diagrams, and be able to prepare from information obtained directly on site map records of overhead lines and underground cables. A sound knowledge of ordnance survey maps is desirable.

Standard application forms, obtainable from the Establishments Officer, above address. Closing date: 28 Mar., 1955.

JUNIOR COMMERCIAL ASSISTANT (TECHNICAL) in the St. Helens District. Salary £475/£520 per annum. (N.J.B. F/14.)

Applicants should be in possession of an Ordinary National Certificate in Electrical Engineering or other equivalent qualification. The duties of the post will include estimating for contracting work, and advising consumers on matters relating to Electricity Supply.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, near Northwich, Cheshire. Closing date: 28 Mar., 1955. (R 205)

MUNICIPALITY OF GEORGE TOWN, PENANG

RESIDENT ENGINEER PENANG POWER STATION

APPLICATIONS are invited for the position of Resident Engineer to supervise, on behalf of the Consulting Engineers, the installation and commissioning of the mechanical and electrical engineering works at the Penang Power Station. The Resident Engineer appointed will also be responsible for the associated civil engineering works, but will be assisted with these by the Resident Engineer (Civil) who has already been appointed.

The initial installation consists of two 10,000 kW turbo-alternators, two 130,000 lb per hour evaporative capacity oil-fired boilers with associated fuel oil, delivery pipe line and storage tanks, 11,000 V and 415 V switchgear and all auxiliary equipment.

The civil engineering works include foundation and buildings for the plant, and circulating seawater works.

Applicants must have had a sound training in mechanical and electrical engineering and practical experience of steam power plant and must be corporate members of either the Institution of Mechanical or Electrical Engineers.

The appointment is for a two-year Agreement commencing in June next, with the option of extension at an inclusive salary of $2,250 per month (equal to £3,150 per annum. $1—2s. 4d.).

Quarters will be provided including heavy furniture rent free and first-class passages out and home, either by air or sea, at the option of the Municipality will be provided for the person appointed and his wife and children under the age of 12 years, if any. A leave allowance of five days per completed month of resident service will be granted upon the expiration of the Agreement.

Applications endorsed "Resident Engineer, Penang Power Station," stating age, marital state, qualifications and experience should be forwarded to Messrs. Preece, Cardew and Rider, Consulting Engineers, 8, 10 and 12 Queen Anne's Gate, Westminster, S.W.1, before Thursday, 31 Mar., 1955.

ALLEN AND WILLIAMS,
Agents and Attorneys.

1 Victoria Street,
Westminster, S.W.1. (R 206)

SURREY COUNTY COUNCIL

REQUIRED ELECTRICAL ENGINEERING ASSISTANT, Grade 1, £500 x £20—£580 per annum plus London Allowance. Should hold National Certificate and have some experience in layout and design of electrical services in buildings. Full details and present salary, accompanied by 3 copy testimonials to County Architect, County Hall, Kingston, by 26 Mar., 1955. (R 196)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

STATION SHIFT CONTROL ENGINEER BARKING "C" GENERATING STATION
Vacancy No. 55/209

Sound engineering training necessary with some experience in control and operation of steam generating plant and main switchgear in modern power station. Salary—Class J, Grade 10=£792. 15s. per annum.

ASSISTANT ENGINEER R. & M. (PLANNING) FULHAM GENERATING STATION
Vacancy No. 55/210

Sound engineering training necessary with experience of power station maintenance work, preferably on Boilers. Salary—Class K, Grade 12=£750. 15s. per annum.

Applications quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (R 231)

YORKSHIRE ELECTRICITY BOARD
Head Office

Chief Engineer's Department

SECOND ASSISTANT ENGINEER—DISTRIBUTION DESIGN (SUBSTATIONS)

DUTIES will include the design of indoor and outdoor primary substations operating at voltages of 33 kV and above, the selection of protective gear installations for the primary H.V. systems, the preparation of specifications and enquiries for substation plant, negotiations with manufacturers and inspection of equipment in course of manufacture.

Applicants should be Corporate Members of the Institution of Electrical Engineers and should preferably possess a University degree in electrical engineering. They should have a sound knowledge of substation requirements and have had experience of large H.V. substation construction. Specialist knowledge of H.V. switchgear or of protective gear would be an advantage.

Salary—N.J.B. Schedule C, Class AX/EX, Grade 2, £950/£25/£1,075 rising to £1,195 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Secretary, Head Office, Yorkshire Electricity Board, Scarcroft, Leeds, not later than 31 Mar., 1955.

No. 7 (Grimsby) Sub-Area

THIRD ASSISTANT ENGINEER (CONSTRUCTION)

Applicants must hold at least the Higher National Certificate in Electrical Engineering and should be preferably Graduates of the Institution of Electrical Engineers. They should have experience in the design, construction, operation and maintenance of H.V. and L.V. Overhead and Underground distribution systems, substation plant and ancillary equipment.

Salary—N.J.B. Class H, Grade 10, £715/£15/£760 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 31 Mar., 1955.

No. 1 Bradford Sub-Area

Skipton District

SECOND ASSISTANT DISTRICT ENGINEER

Applicants should have passed the Graduateship Examination of the Institution of Electrical Engineers, or hold recognised equivalent technical qualifications, have substantial experience in construction, operation and maintenance of high voltage systems, underground cables and overhead lines and substations, and medium and low voltage networks.

Salary—N.J.B. Class D, Grade 7, £675/£15/£720 per annum.

Keighley District

CONSUMERS ENGINEER

Applicants should be Corporate Members of the Institution of Electrical Engineers or hold qualifications leading to such membership, and must have had a sound training with subsequent experience in the work of a Consumers' Department in an Electricity Undertaking.

Details should be given of experience in the following matters:

Negotiations with consumers requiring electricity supplies, tariffs, sales development, application of I.E.E. Wiring Regulations and other relevant regulations in testing and inspecting consumers' installations, electrical installation work, including preparation of specifications and tenders, repair to electrical apparatus, control of staff and workpeople.

Salary—N.J.B. Class E, Grade 8, £675/£15/£720 per annum. It is possible that the Keighley District may be reclassified from 1 Apr., 1955, in which case the salary for the post would be £715/£15/£760, per annum in accordance with Class F, Grade 8.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford, not later than 31 Mar., 1955.

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No. 5 (Wakefield) Sub-Area

Doncaster District

THIRD ASSISTANT DISTRICT ENGINEER

Applicants must have had a sound practical training and considerable experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants should hold a current driving licence and be prepared to reside in the district and undertake standby duties.

Preference will be given to those who are Corporate Members of the Institution of Electrical Engineers, or who hold equivalent qualifications.

Salary—N.J.B. Class F, Grade 9, £675/£15/£720 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 31 Mar., 1955.

No. 7 Grimsby Sub-Area

Grimsby District

METER REPAIRER (MECHANICIAN)

N.J.I.C. Rate of pay and conditions of service, the present rate being 4s. 1d. per hour for a 44-hour, 5-day week.

Applications, giving full particulars of age and experience, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 31 Mar., 1955. (R 217)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (GENERAL)

SOUTHAMPTON District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class F, Grade 11 (£595 x £15—£640 per annum). N.J.B. Conditions of Service.

Applicants should have had experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and distribution equipment. The appointment will involve standby duties.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him in envelopes suitably endorsed not later than 1 Apr., 1955.

JUNIOR ENGINEER

Sub-Area Engineering Department, Newbury. Salary N.J.B. Class K, Grade 18 (£475/£520 per annum). N.J.B. Conditions of Service.

Applicants should preferably have experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and distribution equipment, and possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, and returned to him in envelopes suitably endorsed not later than 1 Apr., 1955.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible. (R 238)

BRITISH ELECTRICITY AUTHORITY
North West, Merseyside & N. Wales Division

VACANCY No. E.92/83/T.—STATION SHIFT CONTROL ENGINEER, Blackburn Generating Station. Salary £675/£720 (G.10).

Vacancy No. E.92/84/T.—DEPUTY STATION SUPERINTENDENT, Bromborough Generating Station, Wirral. Salary £1,110/£1,200 (H.3). Applicants should be fully qualified engineers with wide experience of modern steam power plant, preferably P.F. and an appreciation of modern concepts of administration, financial control, and employee relations.

Vacancy No. E.92/97/T. — SHIFT CHARGE ENGINEER, Fleetwood Generating Station. Salary £755/£800 (F.7).

Apply to Divisional Secretary, British Electricity House, 825 Wilmslow Rd, Manchester 20, before 26 Mar. Quote Vacancy No. (R 225)

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY
Aldermaston, Berks

requires SENIOR SCIENTIFIC OFFICERS and SCIENTIFIC OFFICERS for mainly electrical engineering duties, specialising in communications or electronics, including the following items: Spark discharge phenomena, radar circuits and measurements, high speed and short duration pulse circuits, high voltage techniques, ultra high frequency and very high frequency communication problems, very wide band I.F. and video amplification telemetry. Applicants should have a first or second class Honours Degree in electrical engineering or physics with a bias towards electronics. Previous experience in the above fields will be advantageous. For the S.S.O. grade some years appropriate post-graduate research experience is essential.

Salary Ranges:

Senior Scientific Officer £1,040/£1,205 (male) per annum.

Scientific Officers £505/£905 (male) per annum.

The starting salary of a Scientific Officer is assessed according to age, qualifications and experience. Successful candidates will be required to join the Authority's Contributory superannuation scheme. Housing accommodation will be available within a reasonable period for married staff who live outside the radius of the Establishment's transport facilities. During this period lodging allowance may be payable to suitably qualified candidates. Successful applicants may be required to serve an initial period of detached duty at Fort Halstead, Kent. Send postcard for application form to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote Ref.: 537/WGE/49. (R 239p)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following Superannuable post in the Technical (Electrical) Department based at Ipswich:

GENERAL ASSISTANT ENGINEER (TELECOMMUNICATIONS)

Salary Grade 6, £600 x £25—£725/£785 per annum.

Applicants should preferably possess Higher National Certificate in Electrical Engineering or equivalent qualifications and have considerable experience in the maintenance of automatic and line transmission telephone apparatus. Some knowledge of power supervisory systems and V.H.F. radio would be an advantage.

The duties will be concerned with the Authority's telecommunications systems in East Anglia.

Applications stating age, qualifications and experience should be sent to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, within 14 days of the appearance of the advertisement.

W. N. C. CLINCH,
Controller.
(R 195)

SOUTH WESTERN ELECTRICITY BOARD
Taunton Sub-Area

APPLICATIONS are invited for the post of

ENGINEERING DRAUGHTSMAN

Duties will include surveying and profiling for overhead lines, preparation of Engineering Drawings and Substation layout plans. Knowledge of Building Construction and possession of Ordinary National Certificate an advantage.

Salary N.J.B. Schedule D, Grade 6, £510/£630 per annum.

Applications, in writing, within ten days, stating age and experience, to E. A. Newburn, Manager, Taunton Sub-Area, South Western Electricity Board, Electricity House, The Parade, Taunton. (R 234)

BUCKINGHAMSHIRE EDUCATION COMMITTEE

HIGH WYCOMBE COLLEGE OF FURTHER EDUCATION

(Principal: W. J. Davies, J.P., B.SC.)

ASSISTANT GRADE B required on 1 Sept., 1955, to teach Electrical Engineering and allied subjects; classes held in new buildings. Degree or equivalent and teaching and industrial experience desirable.

Salary in accordance with Burnham Technical Report 1954, i.e. £525 x £25 to £820. Initial salary according to qualifications and experience.

Application forms obtainable (send stamped addressed envelope) from the Principal, Easton St, High Wycombe, to whom they should be returned within fourteen days of the appearance of this advertisement. (R 191)

WAR OFFICE

VACANCIES exist for mechanical and electrical engineering draughtsmen in the designs branch of the Directorate of Fortifications and Works, War Office, Chessington, Surrey.

MECHANICAL DRAUGHTSMEN—(H. and V.)—Applicants must have knowledge and experience of design of low-pressure hot water heating and domestic hot water supply installations. O.N.C. in Mechanical Engineering or equivalent is essential.

ELECTRICAL ENGINEERING DRAUGHTSMEN—Applicants must have several years' experience in the preparation of schemes for the illumination and electrical equipment of buildings or in electrical distribution H.V. and M.V. O.N.C. in Electrical Engineering or equivalent is essential.

Applicants must be British of British parentage.

Salary range is £432 (at 21)—£680 plus overtime. Starting pay according to age, qualifications and experience, with annual increases subject to satisfactory service. Prospects of promotion and establishment. Canteen facilities.

State age, full details of training and experience to Secretary of State for War, War Office (C.5.A), R. 503 Northumberland House, London, W.C.2. (R 149)

LONDON ELECTRICITY BOARD

SENIOR DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Design and Planning Branch of the Northern Sub-Area.

Applicants should have had training and experience in building construction and the design of steelwork and reinforced concrete structures, and be capable of preparing drawings and making calculations for the alteration of existing premises and the conversion of basements into substations and transformer chambers. Experience in the lay-out of electrical equipment up to 11 kV, whilst not essential, would be an advantage.

The post is graded under Schedule D, of the National Joint Board agreement as Grade 5, £672/£777 per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46/7 New Broad St, London, E.C.2, to be returned completed by 31 Mar., 1955. Please enclose addressed envelope and quote ref.: V/1925/T. (R 215)

IMPERIAL COLLEGE

DEPARTMENT OF ELECTRICAL ENGINEERING

APPLICATIONS are invited for two LECTURESHIPS from 1 Oct., 1955. Candidates should possess a good honours degree in Electrical Engineering and preferably have completed a Graduate Apprenticeship or have had similar industrial experience. Salary within range £700 x £50—£1,000 and upwards, according to qualifications and experience, with F.S.S.U. and Family Allowances. Duties will include Undergraduate and Post-graduate teaching and the undertaking of research.

Applications, stating age, academic qualifications and experience, with the names of two referees should reach the Head of the Department, Imperial College, London, S.W.7, by 18 Apr., 1955. (R 170)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

Wear Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER, South Shields District. Salary—Schedule A, Class E, Grade 7—£715/£760. N.J.B. Conditions of Service.

THIRD ASSISTANT DISTRICT ENGINEER, Chester-le-Street District. Salary—Schedule A, Class F, Grade 9—£675/£720. N.J.B. Conditions of Service.

Applicants must be qualified electrical engineers with sound practical training and experience in the construction, operation and maintenance of overhead and underground networks and associated plant and equipment.

Harrogate Sub-Area

THIRD ASSISTANT ENGINEER, Harrogate. Salary—Schedule A, Class G, Grade 10—£675/£720. N.J.B. Conditions of service.

Applicants should preferably have had experience in estimating and survey work, levelling and profiling for overhead lines and in the layout of substations and cable routes.

Applications, stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (R 237)

BRITISH ELECTRICITY AUTHORITY

South Western Division

ASSISTANT SHIFT CHARGE ENGINEER required at East Yelland Generating Station.

Superannuation Scheme. Salary, N.J.B. Class G, Grade 9, £715/£760.

Applicants should have had a sound technical training and practical experience in a modern generating station.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 31 Mar., 1955. (R 216)

SOUTH WESTERN ELECTRICITY BOARD

DISTRICT COMMERCIAL ENGINEER WEST CORNWALL (CAMBORNE)

SALARY N.J.B. Class F, Grade 4—£900/£975 per annum.

Duties include responsibility to the District Manager for all commercial negotiations with consumers, including the technical aspects; supervision of Service Centres and outside Sales Staff; control of installation contracting and consumers' service; organisation of Exhibitions, Demonstrations and Publicity; preparation of Revenue Estimates.

Candidates should possess extensive knowledge of, and have had wide experience in, the commercial side of the Industry and be capable of promoting a progressive commercial development policy. Corporate membership of the I.E.E. is desirable.

Application Forms, obtainable from The Manager, Cornwall Sub-Area, Pool, Redruth, should be returned by 31 Mar., 1955. (R 233)

MIDLANDS ELECTRICITY BOARD

Central Gloucestershire Sub-Area

SUB-AREA MANAGER

APPLICATIONS are invited for the post of Sub-Area Manager at the Board's Central Gloucestershire Sub-Area at Gloucester.

Applicants should have had wide and responsible experience in managerial, engineering, and commercial activities of the Electricity Supply Industry, and preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary in accordance with N.J.M. Agreement, Scale S.A.M. 2, £1,900/£2,150. Superannuable.

Applications stating age, qualifications, experience, present position and salary, should be forwarded, within fourteen days, to: A. Stephens, F.C.I.S., A.M.I.I.A., Secretary, Midlands Electricity Board, Mucklow Hill, Halesowen, Nr. Birmingham. (R252)

MIDLANDS ELECTRICITY BOARD

Worcester and District Sub-Area

APPLICATIONS are invited for the following superannuable posts:

SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER (WORCESTER DISTRICT)

Applicants should have had a sound technical training with practical experience in the sale and installation of domestic and commercial electrical equipment and the wiring associated therewith. Duties will be primarily concerned with the changeover of the equipment of industrial, commercial and domestic consumers from 346/200 V to 415/240 V and will include advising consumers in respect of new appliances, extensions and alterations. Technical qualifications desirable. Salary £715/£760 per annum (N.J.B. Class F, Grade 8).

THIRD ASSISTANT DISTRICT ENGINEERS (TWO) (WORCESTER DISTRICT)

Applicants should have had experience in all branches of distribution work, including construction, operation and maintenance of high and low voltage underground and overhead systems. Technical qualifications desirable. Salary £675/£720 per annum (N.J.B. Class F, Grade 9).

THIRD ASSISTANT DISTRICT ENGINEER (KIDDERMINSTER DISTRICT)

Applicants should have had experience in all branches of distribution work, including the operation and maintenance of high and low voltage cables, switchgear and transformers, planning for system reinforcement and mains extensions. Salary £675/£720 per annum (N.J.B. Class F, Grade 9).

Apply, in writing, within fourteen days, stating age, qualifications and experience, present position and salary to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

A. STEPHENS,
Secretary.
(R 256)

EASTERN ELECTRICITY BOARD

GENERAL ASSISTANT ENGINEERS

REQUIRED in the following localities:

(*a*) Aylesbury District, Chilterns Sub-Area (2 vacancies). 30/55.R

(*b*) Bedford District, Chilterns Sub-Area. 10/55.R

(*c*) Barnet District, Northmet Sub-Area (Ref. 538). 45/55.R

(*d*) Colchester District, Suffolk Sub-Area. 44/55.R

Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, including substations.

Salary for these appointments will be in accordance with Grade 11 of the National Joint Board Agreement as follows:

(*a*) and (*d*) Class E, commencing at £555.

(*b*) Class F, commencing at £595.

(*c*) Class E, commencing at £555 plus London Allowance.

Future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter, stating age, education, qualifications and experience with details of present appointment and salary should be submitted to the District Manager concerned within fourteen days of the appearance of this advertisement

Addresses of District Managers are as follows:

(*a*) District Manager, Eastern Electricity Board, Exchange St, Aylesbury, Bucks.

(*b*) District Manager, Eastern Electricity Board, Prebend St, Bedford.

(*c*) District Manager, Eastern Electricity Board, 7c High St, Barnet, Herts.

(*d*) District Manager, Eastern Electricity Board, Osborne St, Colchester, Essex.

11 Mar., 1955. (R 255)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

BRITISH ELECTRICITY AUTHORITY
Southern Division

APPLICATIONS are invited for the following positions:

OPERATION SUPERINTENDENT
EARLEY GENERATING STATION, READING
S/13.639

Applicants should have had considerable experience of the operation of a modern generating station. The person appointed will be responsible for the efficiency of the generating station plant, the coaling programme and the operation of the coal and ash handling plant and disposal operations. Preference will be given to candidates who have experience in a station with high temperatures and pressures, and pulverised fuel equipment.

Preference will be given to corporate members of a senior professional engineering institution or candidates holding appropriate equivalent qualifications.

Salary: N.J.B. G.6, £840 x £20—£900.

GENERAL ASSISTANT ENGINEER (MECH)
CONSTRUCTION DEPARTMENT, DIVISIONAL HEADQUARTERS, PORTSMOUTH
S/13.640

Applicants should have served an apprenticeship in a manufacturing works or have had equivalent practical training. They should preferably hold technical qualifications leading to corporate membership of an appropriate professional institution or be engaged in an approved course of study leading thereto.

Practical experience, either in the operation, design or installation of modern generating station plant is desirable.

Salary: N.J.B. AX/CX, Grade 6, £600/£765.

Special application forms for each of the above posts obtainable from P. D. A. Oliver, Divisional Secretary, 111 High St, Portsmouth, should be returned by 30 Mar., 1955. Please quote reference S.V.N. (R 257)

BRITISH ELECTRICITY AUTHORITY
South Eastern Division

APPLICATIONS are invited for the following positions.

1. BRIGHTON "A" AND "B" POWER STATIONS

ASSISTANT ENGINEER (Handling)—Class L, Grade 12, £755/£800 per annum.

Applicants must have had proved engineering training, combined with organising and administrative abilities, to control all coaling plant, external ash removal plant, berthing and movement of ships at the jetty for a plant handling 700,000/900,000 tons of coal per annum.

2. DIVISIONAL HEADQUARTERS—TECHNICAL DEPARTMENT

GENERAL ASSISTANT ENGINEER (Communications)—Class AX/DX, Grade 6, £600/£725/£785 per annum, plus London allowance.

Applicants should preferably possess Higher National Certificate in Electrical Engineering or equivalent qualification and have experience in the maintenance of automatic and line transmission telephone apparatus. Some knowledge of power supervisory systems and V.H.F. radio would be an advantage. Successful applicant will be based at Croydon and his duties will be concerned with the Authority's tele-communications systems at this and other locations in the District.

3. LITTLEBROOK POWER STATION

ASSISTANT ENGINEER in the Maintenance Department—Class L, Grade 15, £635/£680 per annum plus London allowance.

Applicants will be responsible for repairs and maintenance of the Ash Plant, also for keeping up-to-date records of plant maintenance. Experience in the control of labour is essential.

4. KINGSTON "B" POWER STATION

(*a*) ASSISTANT ENGINEER (Works Office Co-ordination)—Class G, Grade 7, £790/£850 per annum plus London allowance.

The position requires a person having foresight with an analytical mind coupled with initiative to co-ordinate the operation and maintenance activities of a modern Power Station. Applicants should have experience of both these activities and

continued in next column

continued from previous column

preferably possess membership of either the Institution of Mechanical or Electrical Engineers.

(*b*) ASSISTANT ENGINEER (Projects)—Class G, Grade 9, £715/£760 per annum plus London allowance.

The position requires initiative coupled with an analytical and enquiring mind, and the successful applicant will be engaged on projects designed to improve the efficiency of the power station in all aspects. He will be responsible for the initiation and carrying out of such schemes. A sound knowledge of modern power station practice and the possession of Higher National Certificate or equivalent would be desirable.

Applications giving details of education, present position, experience, etc., should be received by the following according to location of vacancy.

1. Station Superintendent, Brighton "B" Power Station, Portslade-by-Sea, Sussex.
2. Establishments Officer, British Electricity House, Lower Ham Rd, Kingston-upon-Thames.
3. Station Superintendent, Littlebrook Power Station, Nr. Dartford, Kent.
4. Station Superintendent, Kingston "B" Power Station, Downhall Rd, Kingston-upon-Thames.

Closing date for receipt of applications 28 Mar., 1955. (R 251)

CITY OF BULAWAYO
(Southern Rhodesia)

VACANCIES FOR ENGINEERS: ELECTRICITY DEPARTMENT

APPLICATIONS are invited for the tion of Generation Engineer (Gross annual emoluments £1,504 rising to £1,729. 12s.), one position of Senior Engineering Assistant (Gross annual emoluments £1,259. 12s. rising to £1,447. 12s.) and four positions of Electrical and/or Mechanical Engineers (gross annual emoluments, depending on qualifications of persons appointed, extending from a minimum of £883. 12s. to a maximum of £1,334. 16s.).

In addition to the above figures, children's allowances of £30 a year for the first child and £24 a year for each of the second and third children are payable.

Further details of the vacancies, including information relating to the refund of travelling expenses, may be obtained from the Council's London Agents, Davis and Soper Ltd., 52 and 54 St. Mary Axe, London, E.C.3. Applications must reach the "Staff Vacancies Officer, Town Clerk's Department, P.O. Box 591, Bulawayo, Southern Rhodesia," by 11 Apr., 1955.

E. S. WHITE,
Town Clerk

11 Mar., 1955. (R 260)

BRITISH ELECTRICITY AUTHORITY
South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments:

Vacancy No. 26

(*a*) ASSISTANT SHIFT CHARGE ENGINEER, Cardiff Power Station.

Salary: F.9—£675 x £15—£720 per annum.

H.N.C. and regular apprenticeship desirable. Experience in a modern Generating Station essential.

Vacancy No. 28

(*b*) (i) SENIOR DRAUGHTSMAN (Electrical).

Salary: Schedule D, Grade 5—£640/£740 per annum.

(ii) ENGINEERING DRAUGHTSMAN (Electrical).

Salary: Schedule D, Grade 6—£510/£630 per annum.

Candidates should be suitably qualified and have had experience in the preparation of layouts and diagrams for the installation of power station auxiliaries, E.H.T. and L.T. switchgear, transformers and cables. Knowledge of protective gear systems advantageous.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Rd, Gabalfa, Cardiff, by 28 Mar., 1955. (R 258)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

THIRD ASSISTANT ENGINEER (ELECTRICAL)
GENERATION (CONSTRUCTION), CASTLE DONINGTON POWER STATION SITE
Vacancy No. 42/55/ET

Applicants should have had a fundamental training in electrical engineering, including workshops, and should preferably have had experience in the manufacture, erection and maintenance and operation of electrical plant as installed in modern Power Stations. Preference will be given to candidates who possess a Degree or are Graduate Members of the Institution of Electrical Engineers.

Salary will be within Schedule C, Class AX/DX, Grade 4 (£750/£950 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 28 Mar., 1955.

STATION SUPERINTENDENT, CASTLE DONINGTON POWER STATION
Vacancy No. 43/55/ET

Applications are invited for the position of Power Station Superintendent at Castle Donington, now under construction.

Candidates must have served a recognised engineering apprenticeship and have had a wide experience in a responsible position in the administration, operation and maintenance of a modern high pressure P.F. Power Station.

It is desirable that applicants should possess qualifications admitting to Corporate Membership of the I.E.E. and/or I.Mech.E.

The salary will be in accordance with Scale 4 of the National Joint Managerial and Higher Executive Grades (£1,600/£1,750 per annum) and conditions of service those agreed by that Committee.

Closing date for receipt of applications, 28 Mar., 1955.

STATION SHIFT CONTROL ENGINEERS, CASTLE DONINGTON POWER STATION
Vacancy No. 46/55/ET

Candidates should be in possession of the Higher National Certificate in electrical and/or mechanical engineering and have had experience in the control and load despatching of large capacity steam generating plant connected to the National Grid System.

Salary will be in accordance with Class L, Grade 10 (£840 x £20—£900 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 28 Mar., 1955.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.
(R 236)

MIDLANDS ELECTRICITY BOARD
North Staffordshire Sub-Area

APPOINTMENT OF DISTRICT MANAGER

APPLICATIONS are invited for the position of District Manager in the Stoke South District of the North Staffordshire Sub-Area.

Applicants should have had a wide experience in managerial, engineering, and commercial activities of the Electrical Supply Industry, and preference will be given to candidates who are Corporate Members of the Institution of Electrical Engineers or hold equivalent qualifications.

Salary in accordance with N.J.M. Agreement, Scale 3, £1,450/£1,600 per annum. Superannuable.

Applications stating age, qualifications, experience, present position and salary, should be forwarded to Mr H. A. P. Caddell, Sub-Area Manager, Midlands Electricity Board, 31 Kingsway, Stoke-on-Trent, not later than 31 Mar., 1955.

A. STEPHENS,
Secretary.
(R 253)

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

Atomic Weapons Research Establishment Aldermaston, Berks and Foulness, Essex

requires

EXPERIMENTAL OFFICERS and ASSISTANT EXPERIMENTAL OFFICERS to carry out the following duties:

1. 538/WGE/49. Research and development work on electronic instruments used in the observation and measurement of high speed transient phenomena. The equipment includes high speed oscillographs, wide band amplifiers and high speed counters. Experience in radar circuitry, U.H.F. and V.H.F. problems and the use of the above equipment will be of value.

or

2. 539/WGE/49. Measurements of physical phenomena by electronic and/or photographic means. Experience in the following fields will be of value: High vacuum, high voltage, spark phenomena, Radiac instruments, vibration or displacement measurements.

or

3. 540/WGE/49. Research and development work on the application of electromechanical devices to control systems, arming devices, etc.

The minimum qualification is Higher School Certificate (Science) or equivalent. For some posts a degree in electrical engineering or physics is desirable. For Experimental Officer posts experience in the above or similar type of work will be required.

SALARY:

Experimental Officer (minimum age 26) £775/£945 (male) per annum.

Assistant Experimental Officer £310 (age 18) £685 (male) per annum.

SUPERANNUATION:

The successful applicants will be required to join the Authority's contributory scheme.

HOUSING:

Housing accommodation will be available within a reasonable period for married officers taking up duties at Aldermaston who live outside the radius of the Establishments transport facilities. During this period lodging allowance may be payable. An initial period of detached duty at Fore Halstead, Kent, may be necessary in some cases.

Send postcard for application form to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote Appropriate Reference Number. (R 207p)

CITY OF PORT ELIZABETH

Electricity Department

VACANCY FOR METER MECHANICIAN AND TESTER

APPLICATIONS are invited for the permanent position of Meter Mechanician and Tester at a rate of pay of 3s. 11d. per hour, plus Cost of Living Allowance, which is, at present, 68s. per week for single employees, and 101s. 6d. per week for married employees. In addition, merit pay will be payable in terms of the Conditions of Service.

Applicants must be fully experienced and be capable of testing and calibrating polyphase kWh, kVa and M.D.I. meters, standardisation of instruments and transformers, and be thoroughly familiar with the general routine in the Meter Department of a modern electricity supply undertaking.

Further details regarding leave, merit pay, pension fund, etc., can be obtained from Davis and Soper Ltd., 52 and 54 St. Mary Axe, London, E.C.3.

G. H. BREWER,
Town Clerk.

14 Mar., 1955. (R 259)

BRITISH ELECTRICITY AUTHORITY

South West Scotland Division

ASSISTANT SHIFT CHARGE ENGINEER—KILMARNOCK

APPLICATIONS are invited for the position of Assistant Shift Charge Engineer at Kilmarnock Power Station.

The post will be superannuable and the salary in accordance with Class F, Grade 9, of the National Joint Board Agreement will be at the commencing rate of £675 per year.

Applications on Form AE.6 which may be obtained from the Divisional Office of the Authority, should be forwarded to the Divisional Secretary, 168 Broomhill Drive, Glasgow, W.1, before Monday, 28 Mar., 1955. (R 235)

AN ELECTRICAL DESIGNER for Rotating electrical machines is required by South Wales manufacturers. Applicants should possess a Degree or H.N.C. or equivalent, and have had considerable experience in rotating machine design.

The appointment is a senior one, and the successful applicant will be responsible to the Chief Engineer. The position carries an attractive salary, together with a non-contributory pension scheme. Apply—Box No. 4347, Electrical Times. (R 176)

APPLICATIONS are invited from those interested in a position as INDUSTRIAL HEATING ENGINEER and Agricultural Representative for The General Electric Co., Ltd., in London and the Provinces, to promote sales in space heating and other I.H. equipment also in agricultural electrical equipment. Candidates, not over 35 years of age, should have the H.N.C. in electrical engineering or the equivalent, and some previous experience in the selling of the foregoing equipment. A good personality and enthusiasm for sales work are essential. Apply in writing quoting reference I.H. to the Staff Manager, Magnet House, Kingsway, W.C.2. (R 192)

ASSISTANT ENGINEER: required for London Electrical Contractors Office, used to preparation of estimates and specifications. State experience, age, qualifications, salary required.—Box No. 4361, Electrical Times. (R 210)

ASSISTANT SURVEYORS for work at home and overseas having some experience in the survey and profiling of routes for Overhead Transmission Lines. Pension Fund. Apply in writing to Staff Officer, British Insulated Callender's Construction Company Limited, 30 Leicester Sq, London, W.C.2, quoting reference C/83/55. (R 241)

BRITISH ELECTRICITY AUTHORITY, Headquarters, Bankside House, London, require a SECOND ASSISTANT ENGINEER in the Utilisation Research Section of the Commercial Department. Candidates should be Electrical Engineers, preferably with a university degree or equivalent qualification, with an enquiring mind and experience in Electricity Supply. The duties are concerned with researches in the field of supply economics, especially load and distribution cost analysis. Salary N.J.B. Grade 2, £971/£1,325 per annum inclusive. Applications stating age, qualifications, experience, present position and salary, to Director of Establishments, Winsley St, London, W.1, by 30 Mar., 1955. Quote Ref.: AE. 578. (R 244)

BRITISH ELECTRICITY AUTHORITY, Research Laboratories, Leatherhead, require JUNIOR ENGINEERS. Candidates should have a University Degree, Higher National Certificate or equivalent qualification in electrical or mechanical engineering or physics. Duties include research on electro-static precipitation or materials testing or instruments for special applications.

Salary N.J.B. Grade 5, £475/£650 per annum.

Applications to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 31 Mar., 1955. Quote Ref. ET/581. (R 246)

THE STEEL COMPANY OF WALES LIMITED

(Steel Division)

PORT TALBOT

INVITE

applications from suitably qualified men for the following vacancies in their Power Plant Department.

(*a*) ONE DEVELOPMENT ENGINEER.

(*b*) TWO ASSISTANT DEVELOPMENT ENGINEERS.

Applicants should have extensive experience in the technical operation and maintenance sections of all types of boiler and turbine plants.

Some knowledge of the preparation of statistics, project schemes, plant specifications, etc., would be an advantage.

Candidates should be able to produce evidence of advanced technical education in electrical and mechanical engineering.

The positions are permanent and pensionable.

Those wishing to apply should write for official Application Form to the:

Personnel Superintendent,
The Steel Company of Wales Limited,
(Steel Division), Abbey Works.
Port Talbot, Glam.

(R 261p)

BRUSH ELECTRICAL ENGINEERING COMPANY LTD., have vacancies for men of ambition seeking progressive and responsible positions as TENDERING and CONTRACTS ENGINEERS in their Commercial Departments at Loughborough. Applicants should be capable correspondents with experience in one or more of the following: turbo - alternators, rotating machines, switchgear or transformers. Additionally, vacancies exist in the General Engineering Division for men having specialised knowledge of comprehensive power schemes for both diesel and steam generating stations. Appointments will be of a permanent nature with good salaries, and excellent prospects are open to suitable men. Conditions of service include non-contributory staff assurance. Please write with full details in confidence to the Chief Personnel Officer, Brush Electrical Engineering Co., Ltd., Loughborough. Candidates who may wish to obtain further information before making official applications can do so by making contact with our various Branch Managers, located at Glasgow, Manchester, Aberdeen, Birmingham, Bristol, Cardiff, Ipswich, Leeds, London, Newcastle and Sheffield. (R 94)

CONSULTING Engineers require ELECTRICAL DESIGNER/DRAUGHTSMAN, age twenty-four to thirty-five, experienced in all classes of lighting and power installations for hospitals, schools, industrial projects, preparation of contract and specifications, etc. Good draughtsmanship essential. Reply to A. F. Myers and Partners, 147 Victoria St, London, S.W.1. (R 186)

ELECTRICAL ENGINEER

required (aged 30-40, preferably Chartered), to assume leading position—commanding minimum £1,000 per annum to start—in Design Office of London Company. Applicants must be fully conversant with low and medium voltage automatic contactor gear, motors, relay systems, and methods of temperature control. Previous D.O. experience and a thorough knowledge of wiring systems applied to precision machinery is essential. Write, in first instance: Personnel Manager, Molins Machine Co., Ltd., Evelyn St, London, S.E.8. (R 197p)

THE ENGLISH ELECTRIC COMPANY LIMITED

at LUTON and STEVENAGE

have a limited number of interesting vacancies in the MECHANICAL ENGINEERING DEPARTMENT. Initially these appointments are SENIOR DESIGN ENGINEERS, DEVELOPMENT ENGINEERS and PROJECT ENGINEERS all for work in connection with electrical equipment.

Applicants should have H.N.C. or equivalent with some drawing office experience and preferably some experience in electrical development and testing of equipment.

In addition, we are seeking a few DEVELOPMENT ENGINEERS experienced in Mechanical Equipment and with some mechanical drawing office experience. A certain amount of travelling will be involved.

These appointments are of an interesting nature and offer good prospects to the right Engineers. Applications, which will be strictly confidential, should be addressed to Dept. C.P.S., 336/7 Strand, W.C.2, quoting reference 1261F. (R 230p)

BRANCH MANAGER required by well-known London firm of electrical engineers. Knowledge of electrical installation and motor repairs essential.—Box No. 4295, Electrical Times. (R 40)

CHRISTY BROS. LIMITED, Electrical Engineers, Chelmsford, Essex, invite applications for the following positions:

An ASSISTANT ENGINEER required, able to prepare schemes, specifications and estimates for electrical installations in industrial and other buildings. Must also possess a good knowledge of design, L.T. distribution—internal and external, and switchgear up to and including 11 kV. Apply stating full particulars.

DRAUGHTSMAN required with experience of switchboards, relay panels, control desks, customers specialised equipment, and circuit diagrams. Knowledge of sheet metal work desirable. Apply giving full particulars. (R 245)

DEMONSTRATOR (Female) required in the Gloucester District. Applicants must have had good education and should have a certificate of a recognised Domestic Training College and/or the E.A.W. Certificate. Duties include lecture demonstration in Service Centres and on consumers' premises and advising consumers on the selection and use of electrical appliances. Salary £425/£525 per annum (N.J.C. Grade 1). Superannuable.

Applications, in writing, stating age, education, qualifications, training and experience should be forwarded within fourteen days to District Manager, Midlands Electricity Board, Commercial Rd, Gloucester. (R 226)

ELECTRICIANS & ELECTRICAL FITTERS

are required by

BOWATER'S LLOYD PULP AND PAPER MILLS LIMITED

in their Maintenance Dept., Kemsley Mill

Applications by letter to:

Resident Engineer, Kemsley Mill,
Bowater's Lloyd Pulp and Paper Mills Limited
Sittingbourne, Kent

Stating:

1. Age
2. Particulars of Apprenticeship served
3. Experience.

Day Rate 3s. 11½d. Canteen Facilities
Contributory Pension Scheme
(R 194p)

DEVELOPMENT ENGINEERS, experienced Draughtsmen and Trainee Draughtsmen required for expanding development programme of various types of electro-mechanical devices. These are permanent appointments with good prospects of promotion. Superannuation scheme. Present staff are aware of this advertisement. Applications in confidence to the Chief Design Engineer—Box No. 4351, Electrical Times. (R 178)

DRAUGHTSMAN: required for Electrical Contractors London Office. State experience, age, salary required.—Box No. 4359, Electrical Times. (R 209)

ENGINEERS required for expanding department concerned with Traction Control Gear. The work consists of tendering, apparatus design, preparation of diagrams, lay-out of equipment and testing of control equipments for all types of electric and diesel electric rolling stock and locomotives, mining and industrial locomotives, and road transport vehicles. Applicants must have a Degree or H.N.C. in electrical engineering. They must have completed or be exempt from National Service. The posts are permanent and pensionable. Write for application form to: The Personnel Manager, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester 17, marking envelope "O.1." (R 201)

ENGINEER with electrical or physicist degree required for development work on testing equipment for telecommunication cables. Permanent and pensionable position at salary commensurate with experience and qualifications. Please apply giving full particulars to Personnel Officer, Southern United Telephone Cables Ltd., Dagenham Dock, Essex. (R 54)

ELECTRICAL Contractors require ASSISTANT STOREKEEPER. Knowledge of trade essential, also current driving licence. Telephone for interview VIC 7373. (R 213)

ELECTRICAL DRAUGHTSMAN. Simon-Carves Ltd. require an electrical draughtsman to assist the Electrical Engineer responsible for design, purchase and installation of switchgear, transformers, starters, motors, etc., for large industrial plant. Initial salary will depend on qualifications and experience; for a senior man it will range up to £750. 5-day week. Working conditions and scope are good; a pension scheme is in operation. Write, quoting ref. FU 117, to Staff and Training Division, Simon-Carves Ltd., Cheadle Heath, Stockport. (R 200)

ELECTRICAL DRAUGHTSMAN wanted for both diagram and layout work. Minimum qualifications, Ordinary National Certificate. Minimum age, 23. Salary according to age and experience. Canteen facilities. Contributory Pension Scheme. Write in confidence to: Resident Engineer, Bowater's Lloyd Pulp and Paper Mills Limited, Kemsley Mill, Sittingbourne, Kent, marking envelope "Private and Confidential." (R 193)

ELECTRICAL ENGINEER required for Electrical Department of Works in the North East. He should have a sound practical training, drawing office experience, knowledge of motor control gear resistance calculations, and preferably some experience of electrical heating for industrial applications. Apply giving full details of experience, technical qualifications, age, whether married or single, and salary required, to—Box No. 4299, Electrical Times. (R 62)

ELECTRICAL Wholesaler (London) requires experienced TRADE COUNTER ASSISTANTS. Write giving full details, age, experience and salary required to—Box No. 4365, Electrical Times. (R 223)

FITTER (Electrical) required by London Electricity Board in Western Sub-Area, based at South Kensington, London, S.W.7. N.J.I.C. rates and conditions—4s. 5d. per hour. Application forms from Personnel Officer, 46/7 New Broad St, London, E.C.2. Please enclose addressed envelope and quote ref.: M/3710/T. (R 208)

One or two

RESEARCH ENGINEERS

are required by

THE ENGLISH ELECTRIC COMPANY LTD.,

at their

GUIDED WEAPONS DIVISION

at LUTON,

for extended studies into miniature high speed turbines and pumps, hydraulic servo systems and their associated control valves.

The suitable men should be well qualified in mechanical engineering but an ability for original thought, and to work without supervision is of paramount importance.

Salaries will be generous to the right applicants and housing assistance is possible. These posts offer excellent prospects for original work for which every facility will be offered.

Applications to Dept. C.P.S., 336/7, Strand, W.C.2.,

quoting Ref. 1181D.
(R 243p)

ELECTRIC LAMP MANUFACTURERS (ELMA) require live SALES AGENTS for the following areas: (*a*) Gloucestershire and Wiltshire; (*b*) North Wales and Anglesey; (*c*) Northern Ireland; (*d*) Kent and Sussex. Applicants should be well connected with Electricity Boards, Industrial Users and Wholesalers. Apply with details of agencies held, etc., to—Box No. 4335, Electrical Times. (R 145)

GREENGATE AND IRWELL RUBBER CO., LTD., require a TECHNICAL SALES REPRESENTATIVE to further sales of C.M.A. Cables in East Midlands area. Applicants, who are thoroughly conversant with the industry, should write, in confidence, stating full details of experience to the Personnel Officer, Greengate and Irwell Rubber Co., Ltd., Greengate Works, Manchester 3. (R 198)

JUNIOR TRANSFORMER DESIGN ENGINEER required by expanding Company in the North West, with experience up to 3,000 kVA. The position offers considerable scope for person of initiative, a young man wishing to make progress. Apply stating age, salary required, etc., to—Box No. 4367, Electrical Times. (R 227)

SHIFT CHARGE ENGINEER

required by The Steel Company of Wales Limited (Steel Division), Abbey Works, Port Talbot, in their Electrical Distribution Department.

The successful candidate will be responsible for the control, operation and maintenance of electricity supply, generation (output) and distribution systems connected with a large integrated iron and steel plant.

Sound technical knowledge and previous experience with heavy industrial plant essential.

Higher National Certificate or equivalent desirable.

The position is permanent and pensionable.

Those wishing to apply should write for official Application Form to the:

Personnel Superintendent,
The Steel Company of Wales, Ltd. (Steel Division)
Abbey Works,
PORT TALBOT, GLAM.
(R 248p)

GENERAL MANAGER

IGRANIC ELECTRIC COMPANY LIMITED

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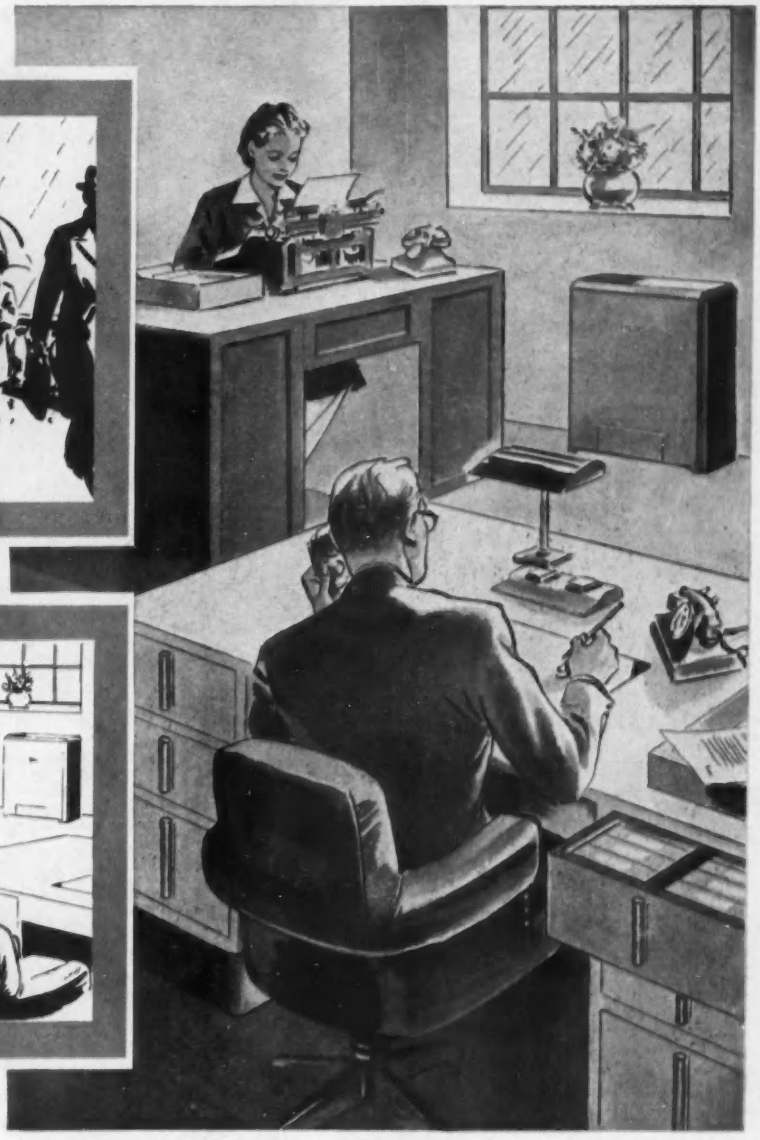

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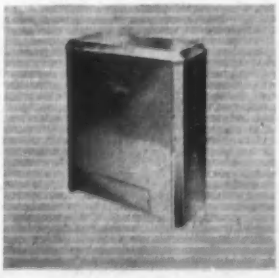

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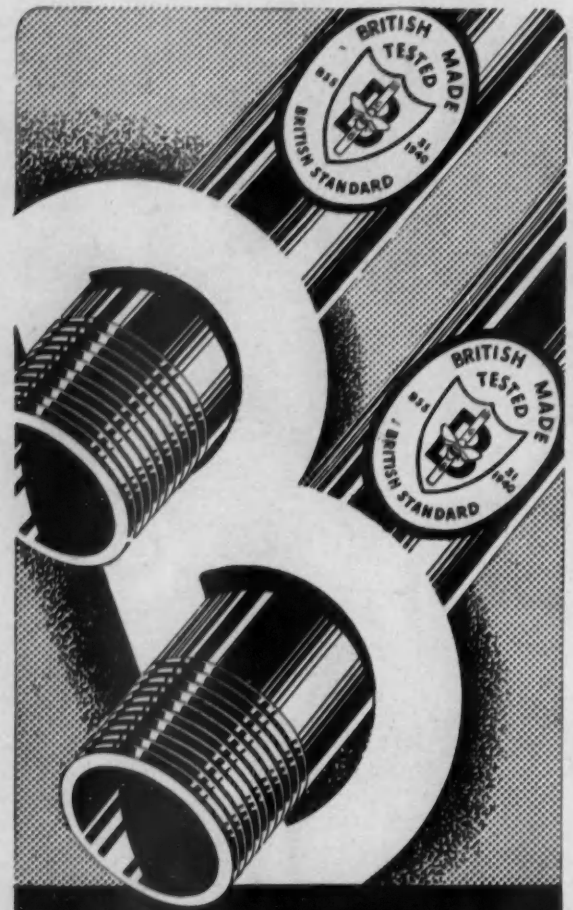

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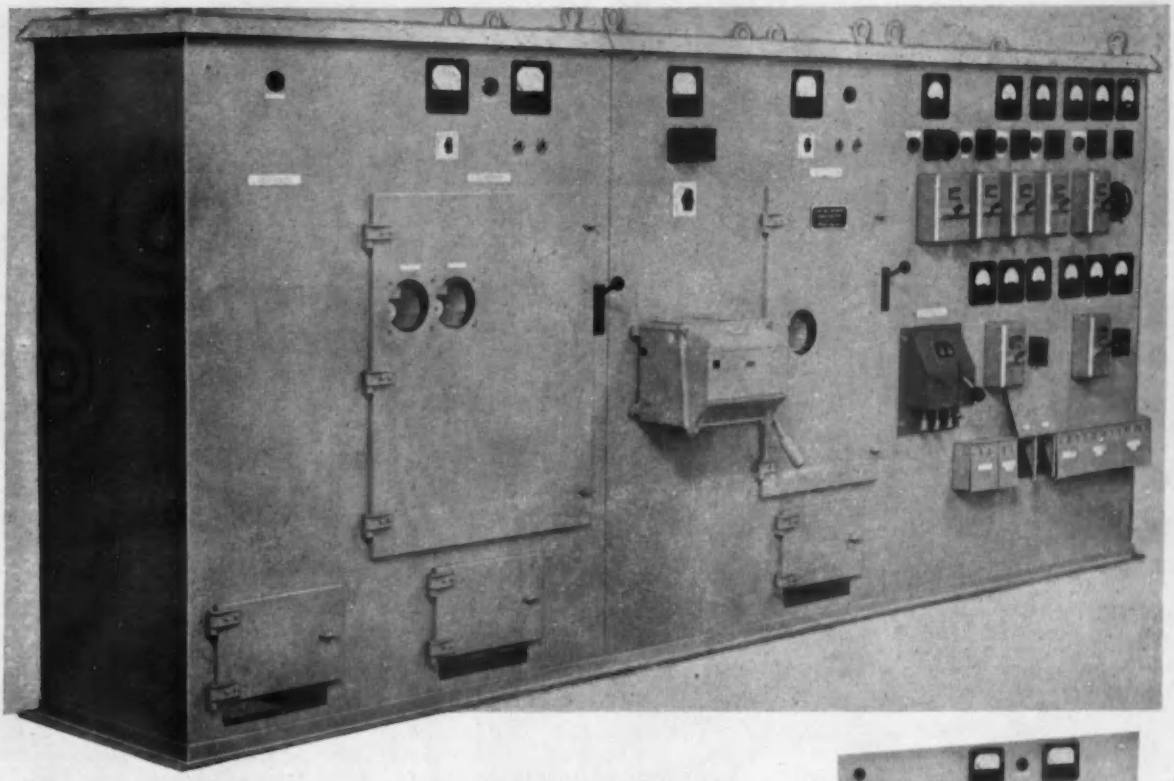

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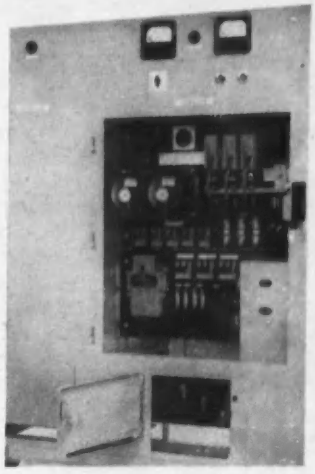

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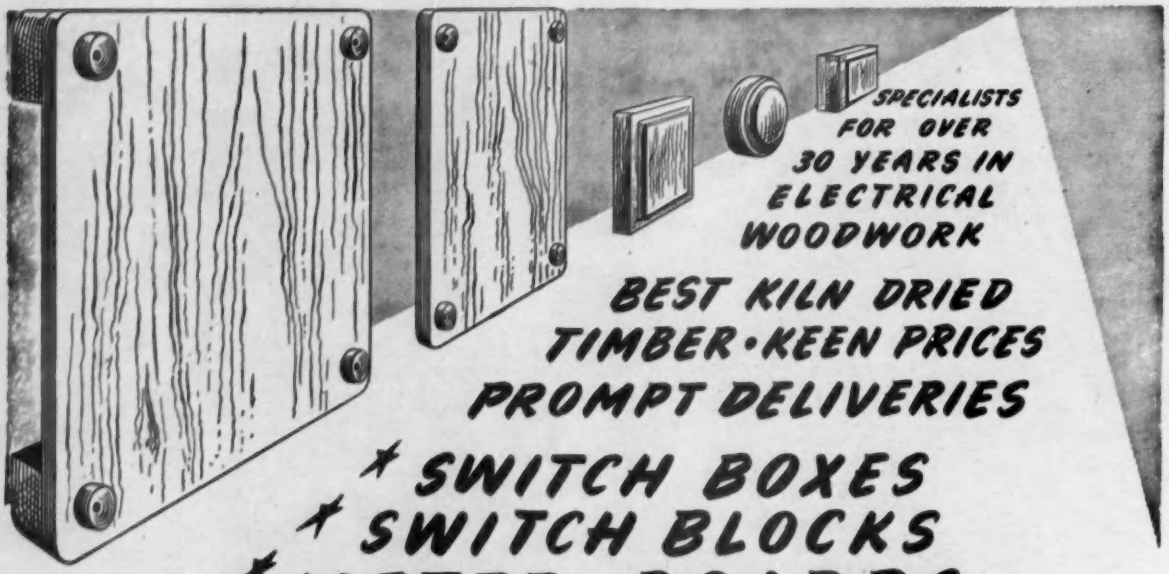

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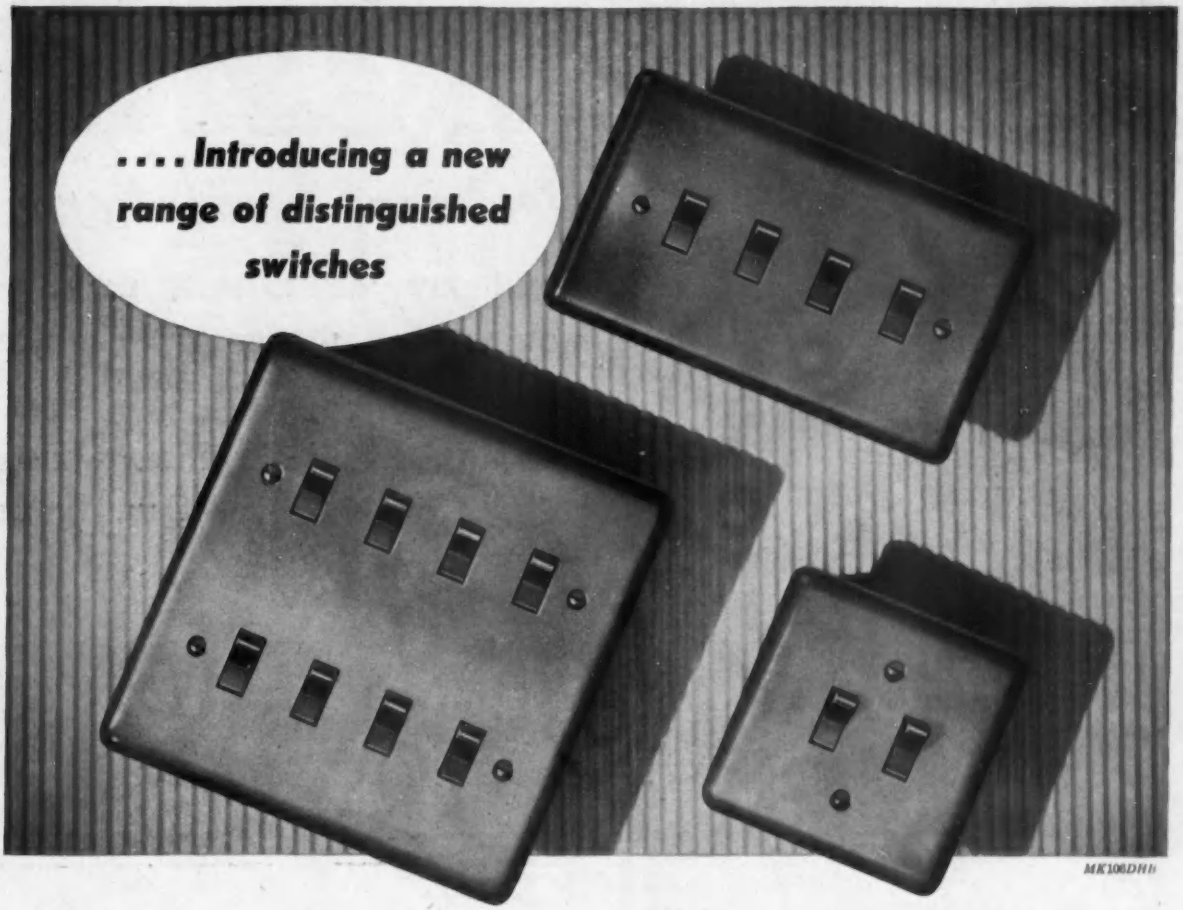

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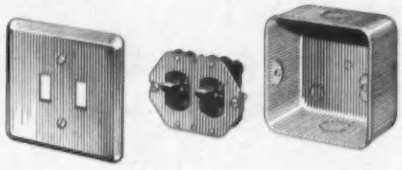

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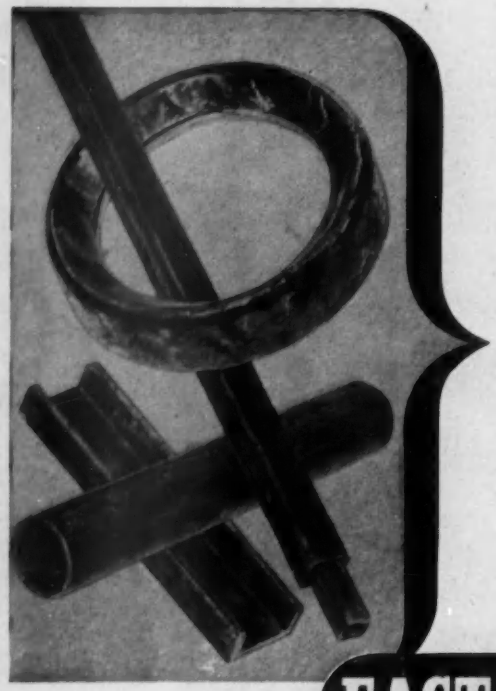

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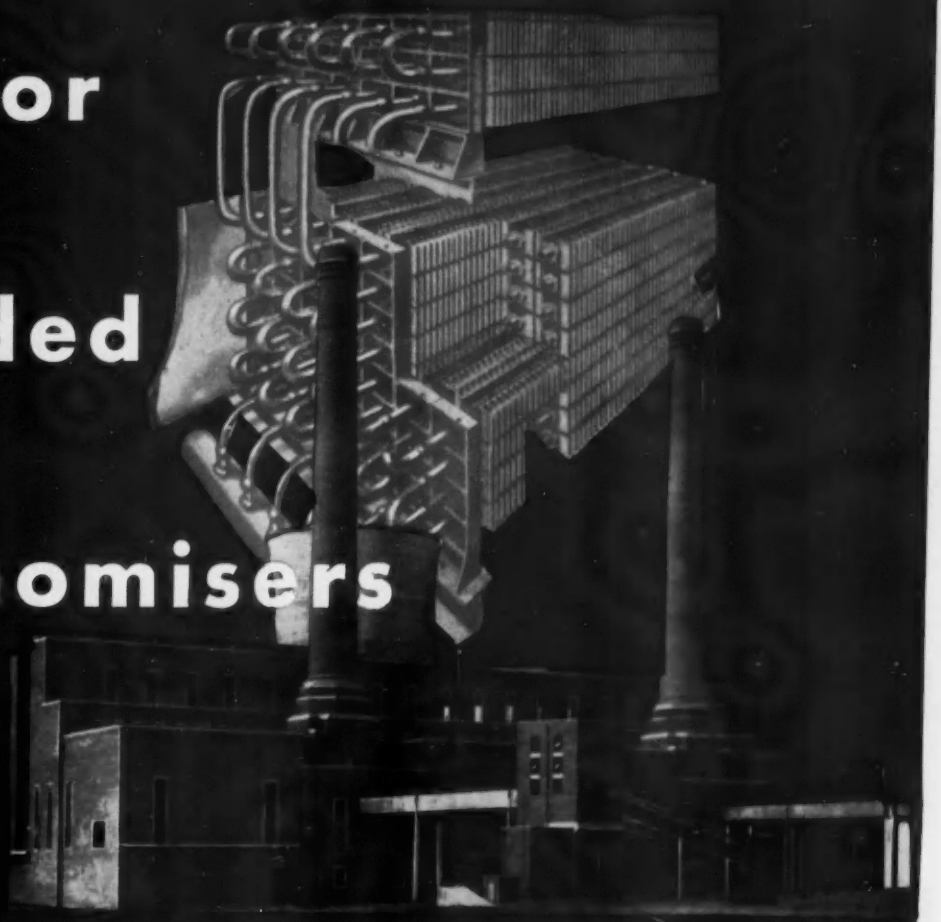

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